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VOL. XXI. NEW YORK, JUNE 10, 1893. NO. 23

CONTENTS.

EDITORIAL: PAGE.

Paragraphs ... 423

ILLUSTRATED ARTICLES:
Alternating Current Motors, by H. Behn-Eschenburg ... 424
Tests of Street Railway Return Circuits, by L. T. Gibbs ... 425
Electricity at the World's Fair ... 426
Windmills for Electric Lighting, by G. H. Morse ... 429
An Automatic Printing Speed Counter, by G. S. Moler ... 431
A Modified Deprez-D'Arsonval Galvanometer ... 431
THE ELECTRICAL WORLD'S Digest of Current Technical Electrical Literature, by Carl Hering ... 432
Electric Launch for the U. S. S. New York ... 435
New Block Signal System ... 435
A New Incandescent Lamp ... 436
Miner's Boring Machine ... 436
The La Roche New Alternating Current Dynamo ... 436
A New Conduit Railway System ... 436

MISCELLANEOUS:
Notes on That Badge and Incidentally on the Origin of "Electricity," by Park Benjamin ... 424
The Blackening of Incandescent Lamp Bulbs ... 424
Symbol for Current, by Gisbert Kapp ... 424
Moonlight Table for June, 1893 ... 424
Currents from Commercial Circuits for Medical Purposes, by C. Doutre ... 424
Electrical Notations, Abbreviations and Symbols ... 430
A Sensation in Electric Heating ... 430
The Student Course at Lynn, by J. B. Pitman ... 434

FINANCIAL INTELLIGENCE, 437; New Incorporations, 437.

SPECIAL CORRESPONDENCE: New York Notes, 437; New England Notes, 437; Western Notes, 438.

NEWS OF THE WEEK: The Electric Light, 438; The Electric Railway, 438; Legal Notes, 439; Miscellaneous Notes, 439.

INDUSTRIAL AND TRADE NOTES ... 439

BUSINESS NOTICES ... 439

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS ... 440

Speed Counters. WHOEVER has had much to do with experiments involving the determination of revolutions of shafts will appreciate the value of the automatic printing speed counter devised by Prof. Moler, a description of which we print elsewhere. The continuous printed record of the trial not only reduces the labor but adds largely to the accuracy. While for the purpose for which the counter has been designed it no doubt answers admirably, yet it seems difficult to adapt it for portable use. A self-contained portable speed counter for high speeds where accuracy is required, and one easily applied, can be made by combining an electrical escapement with a stop clock. The escapement may be like those used on some forms of printing telegraphs and a good jeweler can apply a stop arrangement to the balance wheel of a small clock. With the stop lever of the clock connected to the arm of a small switch, the escapement and clock may be simultaneously started and stopped by the same motion. The escapement is run from a current through a contact on the shaft and all the hands are brought back to zero through a single motion of an arm actuating heart cams on each hand. Such a counter has been in constant use for several years registering speeds up to 1,200 revolutions per minute, notwithstanding very rough usage. The second hand, it may be remarked, can easily, with a little practice, be stopped within a quarter of a second. The instrument has registered up to 1,800 revolutions, and it would not be a matter of difficulty to construct one registering to 3,000 revolutions or greater.

Electric Railway Return Circuits. THE article by Mr. Lucius T. Gibbs in another column calls attention in a forcible way to the question of electric railway return circuits. The practice mentioned of connecting the return circuit to underground piping is, of course, entirely indefensible, and the public is now probably sufficiently enlightened to not again permit it. As to the effect of the ordinary ground return circuit, where the current is large it is difficult to see how damage to underground piping can be entirely avoided. The worst result will occur with a negative return, but with a positive return, even with a good connection with the piping system at the station end, damage will result from shunt currents through portions of the soil possessing good conducting properties. On the other hand, a positive return will be fatal to the tie wires and supplementary conductor, so that what is better in one case is the reverse in the other. The West End road of Boston, as well as several other more recent roads, have, we understand, dispensed with the return ground and have an overhead return connected at short intervals with what was before the supplementary ground wire. Even here trouble will be met with in the difficulty of maintaining a good connection between the iron and copper, a difficulty which Mr. Gibbs refers to in another connection in his article. The ideal method will be attained when, by means of the electric welding process, the rails will be continuous conductors for great lengths; breaks necessary to provide for contraction and expansion, being comparatively few in number, can then be provided for in a substantial manner. Aside from the interference with telephone circuits and damage to piping by electrolysis Mr. Gibbs shows that the short life of tie wires and the loss through resistance may be so great as to justify the adoption of heroic measures, so that it is probable that the solution of the problem, for large systems at any rate, is not far distant.

Windmills for Electric Lighting. WITH the exhaustion of coal deposit our posterity will no doubt attack in a more energetic manner than has heretofore been done the problem of the economical utilization of the energy residing in the winds and in the tides. Up to the present, aside from cases very exceptional in their character, the use of coal as the source of energy has been found to be much more economical than the employment of either of the agents named. Indeed, with the increase of efficiency of the steam engine, water power is even placed at a disadvantage if the cost of the works necessary for its utilization reaches a price per horse-power that but a short time ago was considered reasonable. The question of economy is purely one of arithmetic, and can be easily applied to any given case. On the one hand are the first cost of a windmill, of a sufficiently large storage battery, and interest, depreciation, repairs and attendance; and on the other, the same quantities with reference to a steam plant. In addition to the financial view, the question of reliability must also be considered, and in this respect the great advantage of steam will go far toward offsetting any gain in running expenses resulting from the use of the other agent, should there be such in any case. It cannot be too strongly emphasized that the fact that power costs little or nothing is no criterion that it can be cheaply utilized. The cost of the preliminary works and the reliability of a system, to which we have referred above, may be supplemented by many other factors, so that nothing definite can be asserted in a particular case until the effect of all of these has been determined. In the article on Windmills for Electric Lighting, by Mr. Morse, in another column, a quantity of interesting data on the subject is given, from which it does not seem that such plants can as yet be considered commercially feasible. We note that mention of one of the most important windmill electric plants is omitted—that of Mr. E. H. Johnson, at Greenwich, Conn.

On Light and Other High Frequency Phenomena. THE lecture of Mr. Nikola Tesla, the full text of which was given in the last issue of THE ELECTRICAL WORLD, deserves more than the brief notice it received in our editorial columns at that time, for it is only after a most careful perusal that the salient features of this important work are brought to light and its real value fully appreciated. The results of scientific research are usually laid before the world in so technical and uninteresting a form that when an investigator clothes his thoughts in language that is at once beautiful in its simplicity and accurate in its expression, the public instantly marks its approval, as is evidenced by the keen interest taken in every public utterance of Mr. Tesla. This lecture, even in a more marked degree than the previous ones, is an illustration of the peculiarly happy style which characterizes Mr. Tesla's writings, and it stands almost alone in the annals of science for the importance of its subject matter, the elevation of its thought and the grace and beauty of its expression. While it is called a lecture, it is in reality a scientific treatise, and in the effort to make it popular, technical accuracy has not in any way been sacrificed. Mr. Tesla has embodied in this lecture only the latest results and newest developments of his work along this line of investigation, and it is a report of the progress made since his last contribution, repeating only such matter from his previous lectures as was necessary for a clear understanding of the subject. After a beautiful peroration upon the wonders of "that divine organ of sight," the human eye, he states that it is his intention to inquire into the nature of that by which it (the eye) is affected, and to illustrate in a general way the answer to the question "What is light?" in the modern sense of the word. A brief description of the mechanism of disruptive discharges is given, and several methods to lower disruptive resistance are shown, and attention is called to a means of transforming a continuous current of high tension into a direct current of low tension, which, it is thought, may find employment in the arts. An apt mechanical analogy makes plain the nature of a disruptive discharge, and the great loss of energy in disruptive effects in air by the bombardment of the molecules and by sound waves is referred to. Six different methods of obtaining high rates of vibration are given, and the author then proceeds to an experimental illustration of phenomena produced by electrostatic force. Some beautiful experiments are performed, and the exact nature of electrostatic force defined. It is also explained why high frequency currents of enormous energy are not injurious. All these phenomena are due to the presence of a medium like air, and would not occur in a continuous medium. It is under the head of current or dynamic electricity phenomena, which is next taken up, that some of the most interesting results from a practical standpoint are obtained. It is shown that not only may currents be made to flow through open circuits, but they may be made to do work, such as lighting a lamp or operating a motor. A number of ways of running a multiphase motor are described, and it is stated that although such experiments at the present time are only of scientific interest, the day is not far distant when they may have a practical value. Mr. Tesla further states that he has found it practicable to operate ordinary series or shunt direct current motors with disruptive discharges, and that too without a return wire. The subject of electrical resonance is here taken up for the first time in any of the public lectures of Mr. Tesla, and is very thoroughly treated, particularly in reference to its practical details. This is a subject of great importance, and the value of Mr. Tesla's work along this line cannot be over-estimated. In connection with resonance effects and the problem of transmission of energy over a single conductor, we may well quote here the author's own words: "My conviction has grown so strong that I no longer look upon this plan of energy or intelligence transmission as a mere theoretical possibility, but as a serious problem in electrical engineering, which must be carried out some day. The idea of transmitting intelligence without wires is the natural outcome of the most recent results of electrical investigations." The light effects proper are divided into four classes, which are then treated at considerable length. The great importance of the presence of a rarefied gas or atomic medium for the production of heating effects is insisted upon, and it is shown that there are two distinct causes which determine the incandescence of a wire or filament with varying currents, conduction current and bombardment. The incandescence of a refractory button receives considerable attention, while that most interesting subject, phosphorescence, is dealt with at some length, and many interesting facts brought out. The explanation of the incandescence or phosphorescence of gas at low or ordinary pressure is sought in the same primary causes, viz., the shocks or impacts of the atoms. Many other points in this most fascinating lecture might be brought into prominence, for there are scattered throughout its entire length facts of the greatest value and hints of future developments which may revolutionize not only this department, but the whole world of science. This patient investigator is seeking not alone the practical development of electricity but the fundamental principles of all science; to use his own words: "The day when we shall know what 'electricity' is will chronicle an event probably greater, more important than any other recorded in the history of the human race." And who is doing more to advance that day than Nikola Tesla?

Notes on That Badge and Incidentally on the Origin of "Electricity."

BY PARK BENJAMIN.

1. Its outline is said to be that of Franklin's kite. Franklin, however, says that he made his kite "of a small cross of two light strips of cedar, with the arms so long as to reach to the four corners of a large, thin, silk handkerchief when extended." Handkerchiefs are ordinarily square. Have the designers of that badge discovered that Franklin used them of the shape exhibited?

2. In the middle of the badge appears a thing which is said to be a galvanometer, but which is, however, marked as an ordinary compass. In any event, what is the needle doing at a deflection of ninety degrees to the wire, especially in a Wheatstone bridge?

3. The following statement is from the description: "The amber of which the galvanometer is made represents the first conception of electricity, dating back to 600 years B. C., when Thales, the Greek philosopher, recorded the fact that amber, when rubbed, attracted light particles to it, and the Greeks worshipped it, believing that the gods had endowed it with life, and that it possessed a soul." To begin with, the first conception of electricity does not date back to 600 years B. C. There was no conception at all of electricity at that time. If Thales recorded the fact stated, it would be interesting to know where he did it, or on what authority the assertion is made. The Greeks did not worship amber any more than they worshipped many other inanimate things to which they ascribed vitality. The first recorded statement about the attraction of amber is in the "History of Stones" by Theophrastus, who wrote about 300 years B. C. The Thales story, I believe, originates in the "Lives of the Philosophers," by Diogenes Laertius, who gives a life of Thales, and who says that he knew of the theory of the amber soul.

4. Here is another statement: "In 1600, Dr. Gilbert, Court Physician to Queen Elizabeth, coined the word 'electricity' from the word 'elektron,' the Greek name for amber." Gilbert didn't do anything of the sort. What he did do was to give the name "electrica" to certain substances, which he, for the first time, discovered would attract light bodies, and which act, as he says (not "in the same way as," as Mr. Mottelay translates him, but) "for the same reason as" the amber. Gilbert derives the word, not from the Greek "elektron," but from the Latin "electrum." Whether the Latins took their word from the Greek is a question. The original Latin name for amber was "succinum," meaning "sap;" but it is argued by some writers that the term "electrum" became applied to amber because of its resemblance to the brilliant, gold-colored alloy of that name. The word that Gilbert coined, therefore, was a Latin word—"electrica." This was translated by Dr. Barlow, writing in 1616, to mean "electrical bodies," and he called the "taking up of things" by such bodies "electrical attraction." That was the first use of the word "electrical." Sir Kenelm Digby, in 1644, uses exactly the same terms, and speaks of the electrical attraction also as the "electrical virtue" or "effect." The English word "electric" and the English word "electricity" were invented by Sir Thomas Browne and written in his "Inquiries Into Vulgar and Common Errors—1646." He says: "The attractions of these electrics were observed to be very different. . . But if gently warmed at the fire and wiped with a dry cloth, they will better discover their electricities." It is possible that the Latin word for electricity may antedate Browne, and this will depend upon when the Latin work by Van Helmont, which Charleton translated into English under the name of "A Ternary of Paradoxes," and published in 1650, first appeared. Charleton says as follows:

"The phansy of amber delights to allect strawes, chaffe and other festucious bodies, by an attraction, we conferse, obscure and weake enough, yet sufficiently manifest and strong to attest an Electricity or attractive signature."

However this may be about the Latin term, it appears to be clear that the name of the great science, as we now use it in the English language, originated with Browne.

The Blackening of Incandescent Lamp Bulbs.

A recent paragraph in the Digest, referring to one of the theories of the blackening of lamp bulbs, namely that it is due to the evaporation of carbon, recalls a paper by Prof. Elihu Thomson, published in a recent number of the "Lehigh Quarterly," which shows that he has held this view for many years, his experience since then having tended to confirm his views. The paper is entitled "The Life of Incandescent Lamps" and contains a number of points of interest, some of which may not be generally known.

In answer to the question, Can a filament be made which will not deteriorate and therefore not blacken the interior of the bulb? he is inclined to think that it cannot, if carbon is adhered to, and carbon as yet seems to be the best material in existence; it is so on account of its infusibility and its apparent volatility. It actually does soften at extremely high temperatures, and will bend readily when so softened. It does not melt at the highest known temperature, but it readily vaporizes in the arc lamp. It is very probable that carbon, infusible as it seems, could be fused at arc temperatures while under pressure. Thus, an electric arc in an inert gas at high pressure would probably drip melted carbon, which would form graphite in masses or crystals.

The deterioration of incandescent lamps has often been laid to the bonbardment of gas molecules, but Prof. Thomson has long been convinced that in a well exhausted lamp it is due almost entirely to evaporation by high temperature. Just as ice evaporates in vacuo so carbon acquires in vacuo a certain volatility at an increasing rate of the temperature. He assumes, of course, that the vacuum is so good that none of the bluing or visible discharge of current takes place, which of course wears the filament by actual carriage of carbon. He thinks that it would be very strange if carbon maintained at so high a temperature in a vacuum did not evaporate at all, as it is well known that almost all substances raised to a sufficiently high temperature do give off insensible vapors, and that melted metals frequently behave as mercury does at the ordinary temperature; the presence of foreign substances and gases will in some instances accelerate the action or perhaps in other cases retard it. In a lamp a certain evaporation takes place which is independent of the size of the bulb, from which it follows that the age coating will become much less as the bulb is greater in size, for the same deposit will yield a much thinner coating of carbon over a large surface than over a small one. If one lamp were made with the smallest possible bulb and another with a large bulb, the former might be rendered opaque, while the latter would only be slightly darkened, other conditions being the same. He puts great stress on the uniformity of the filament and gives the reasons. It appears to be true, he says, that the limit of practical improvement in the efficiency of incandescent lamps is to be found in the properties of the element carbon, and particularly its volatility. It is fairly safe to say that no other less volatile substance has yet been found, and that carbon, as pure and perfect in structure as possible, is likely to hold its place, at least for some time to come, as the material for incandescent lamp filaments.

Symbol for Current.

BY GISBERT KAPP.

Your suggestions to retain the symbol C for current will, I hope, be adopted at the congress, with the limitation that it is to be used to denote continuous currents only. It is, however, desirable to have a different symbol for alternating currents, and for these we may well adopt Mr. Hospitalier's symbol I. The late Mr. W. H. Snell, at one time editor of the London "Electrician," suggested many years ago that the letter C be used to denote continuous and the letter i alternating currents. I have adopted his suggestion immediately it was made, and used these symbols in all my work ever since, finding it advantageous to have distinctive symbols for the two classes of current.

Moonlight Table for June, 1893.

Herewith we give Mr. H. W. Frund's table of lighting hours for the month of June, under his modified form of moonlight schedule:

TABLE NO. 1. Standard Moonlight. Philadelphia System.				TABLE NO. 2. Frund's New Moonlight System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	7:50 P. M.	1	10:40 P. M.	1	7:50 P. M.	1	12:00 M.
2	7:50	2	11:30	2	7:50	2	12:00
3	7:50	4	12:10 A. M.	3	7:50	3	12:00
4	7:50	5	12:40	4	7:50	5	12:40 A. M.
5	8:00	6	1:10	5	8:00	6	1:10
6	8:00	7	1:30	6	8:00	7	1:30
7	8:00	8	1:50	7	8:00	8	1:50
8	8:00	9	2:20	8	8:00	9	2:20
9	8:00	10	2:40	9	8:00	10	2:40
10	8:10	11	3:10	10	8:00	11	3:10
11	8:10	12	3:30	11	8:10	12	3:30
12	8:10	13	3:30	12	8:10	13	3:30
13	8:10	14	3:30	13	8:10	14	3:30
14	8:10	15	3:30	14	8:10	15	3:30
15	8:10	16	3:30	15	8:10	16	3:30
16	9:20	17	3:30	16	8:10	17	3:30
17	10:00	18	3:30	17	8:10	18	3:30
18	10:30	19	3:30	18	8:10	19	3:30
19	10:50	20	3:30	19	8:10	20	3:30
20	11:10	21	3:30	20	8:10	21	3:30
21	11:30	22	3:30	21	8:10	22	3:30
22	11:40	23	3:30	22	8:10	23	3:30
23	11:50	24	3:30	23	8:10	24	3:30
24				24	8:10	25	3:30
25	12:20 A. M.	25	3:30	25	8:10	25	12:00 M.
26	1:10	26	3:30	26	8:10	26	12:00
27	1:50	27	3:30	27	8:10	27	12:00
28	No light.	28	No light.	28	8:10	28	12:00
29	No light.	29	No light.	29	8:10	29	12:00
30	No light.	30	No light.	30	8:10	30	12:00

Total hours' lighting, 133.

Currents from Commercial Circuits for Medical Purposes.

BY C. DOUTRE.

In answer to the article "Currents from Commercial Circuits" for medical purposes by H. E. Waite, M. D., in The Electrical World of May 20, I will give my opinion on the subject, but I have no doubt that by doing so I shall make a target of myself for the arrows of battery makers in general.

I have had considerable experience in the making and using of electro-medical apparatus to be used in conjunction with currents taken from commercial circuits, and I have no doubt that currents used from commercial circuits are perfectly safe, provided the instruments are first class and the parties using the same thoroughly understand them, and, of course, due precaution taken. It is like everything else used in the medical profession, chloroform, ether, and a great many other things—if care is not taken, naturally serious results follow.

Doctors in the Western States are using currents from commercial circuits with great success, especially in Minneapolis and St. Paul, Minn. Several doctors in the above named cities have made their own instruments, suited to their various uses (a practice not to be recommended), but if you should ask them why they do it, they say: "Well, as we cannot buy them if we want anything in that line we have got to make them ourselves."

I have made several instruments to be used on commercial circuits, and have always got A1 results. I made a rheostat for a doctor which worked to perfection—he was capable of obtaining all the way from one volt, one milliampere, to 106 volts and 1,000 milliamperes, and with a clay electrode he was capable of giving a patient 250 milliamperes at a voltage from one to twenty-five volts, and this without any burning sensation whatever (this was on a circuit of 106 volts). The instrument in question was a shunt rheostat, the current used being always taken from the shunt circuit. A very delicate adjustable circuit breaker was used in the shunt circuit, which I made myself, and it was so delicate that a difference of 3 milliamperes would open the circuit. On several occasions we experimented to see what would be the results of, first: A short circuit; second, an increase in voltage, and, third, a cross with another wire of twice the initial voltage. At the time of making the first experiment I had the wet electrodes in my hand, and there was passing through my body 27 milliamperes at a pressure of 18 volts. We fused a 25 ampere fuse, and I did not feel any perceptible shock. In the second case we adjusted the circuit breaker to open the circuit at 20 milliamperes (all these experiments were made with one wet electrode in each hand, the current passing from one hand through the body to the other hand); when the voltage was raised on the main circuit from 106 to 115 volts, the milliampere meter hand indicated 23 milliamperes when the circuit breaker opened the circuit, and, as in case No. 1, I felt no appreciable shock. In trial No. 3 we left the circuit breaker in the same position as in trial No. 2, and instead of switching on the 106 volt circuit, we switched on the 212 volt circuit. The circuit breaker instantaneously opened the circuit with no bad results. Now put these same instruments in the hands of a person who did not know how to use them, and he in all probability would get such shocks as would make him firmly believe to his dying day that there is danger in using currents from commercial circuits.

I have made instruments for cautery work, dentists' work, such as dryers, etc., and, in fact, for every imaginable purpose, and in all cases, if due precaution is taken, there is no more danger in using the above than there is in using chloroform or ether. The people who make the loudest cry against using current from commercial circuits are the makers of primary and secondary batteries, and it is quite natural, too, for the doctors are numbered among their best customers; but when it comes down to the real cold facts in the case, what the majority of battery makers don't know about electro-medical instruments, used in conjunction with currents taken from commercial circuits, would fill a large book.

As I have said before, there is plenty of room for good work in this line, but it must be good; for if not, bad, if not serious, results are sure to follow.

Alternating Current Motors.

BY HANS BEHN-ESCHENBURG.

In the summer of 1892 I succeeded at the "Maschinenfabrik Oerlikon" in inventing and constructing various types by simply reforming the existing "drehstrom" motors, the various mechanisms for starting which Mr. E. Arnold, of the "Maschinenfabrik Oerlikon," has lately described in several journals. C. E. L. Brown had published an exact imitation of this motor to which he gave his name, when several Oerlikon motors had already for a long time been practically in use. I have now in print a detailed article about the exact theory of the motor and its historical origin, especially concerning the claims of E. Thomson and Tesla, which come now into publicity, after having been without result for years; they were, for instance, totally unknown to me at the time of my invention.

Along with the undeniable advantage of the simplest and most reliable working conceivable, this motor has, especially with the larger types, the following disadvantages: First, When starting full loaded, of consuming a current several times larger than that of normal working; second, When running unloaded, of consuming a current considerably larger than the magnetizing current; third, of allowing but a very limited variety of speeds and overloads.

For several weeks I have been hard at work in the "Maschinenfabrik Oerlikon" constructing a motor for single-phase alternating current, which does not have these disadvantages. I have been successful in designing a motor with collector commutator and brushes, which starts full loaded with a current hardly larger than the magnetizing current, and the speed and torque of which can be altered at pleasure and in the simplest

way, quite independent of periodicity. This motor does not show more sparking than any direct current dynamo.

The principle is exceedingly simple; every one will see at a glance that the efficiency of the new motor must be far superior to that of the former one, from theoretical reasons. The sketch gives an idea of the motor. The current is conducted by the brushes, B1, B2, into a system of windings, which are placed and connected with the collector in exactly the same manner as the windings of the armature of a direct current dynamo of any of the known types. Facing the system of these windings is placed a system of closed windings, where the first system is producing electromotive forces. In the sketch the second system is arranged like the first system, which is enclosed by it. It is constructed with a continuous iron ring and Gramme ring windings, but might, of course, also be constructed of drum windings, or after the manner of the field windings of a direct current dynamo. The sum of electromotive forces induced in these is naught, if they are not circuited through contact of different points, 1, 2, 3, 1^1, 2^1, 3^1 and so on. In these circuits this sum may be positive or negative, large or small, according to the chosen points of contact.

Between the field system and the currents induced in these circuits there arise torques. The intensity and direction of the torque may be varied as desired by altering the points of contact or varying the regulating resistances (R W 1 or R W 2) put into the primary or the secondary system.

In the sketch the simplest case is observed. The points of contact 1, 2, 3, and so on are connected with the opposite 1^1, 2^1 and 3^1 and so on, so there is a perfect analogy between the secondary system and the primary one, provided that the points of contact are arranged in form of a collector, on which, by a speed governor, brushes are in motion, either arbitrarily or automatically. These brushes are circuited through R W 2.

One can see that this motor works just like a series motor for direct currents. The contacts are always at the neutral or sparkless parts of the collector. In fact, the formation of sparks is quite the same as that of a direct current dynamo. The motor can also work just the same if the current is conducted from the generator into the stable outer system, through the points of contact 1 and 1^1, 2 and 2^1, and so on. Then the armature acts as an induced system, and the brushes have to be circuited with one another. To provide for this case, I gave the brushes a particular construction, which is meant to avoid the sparking, for here the brushes touch sparking places.

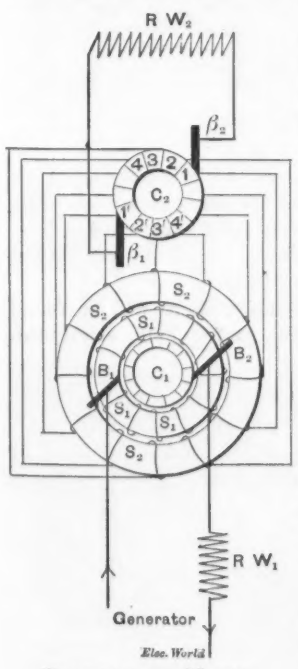


DIAGRAM OF MOTOR.

The speed of the motor depends on the amount of the torque and the load. Therefore this motor is especially fitted for all cases of motor work, where large torques are wanted for starting, or where the speed is to be variable; for example, for the working of tramways, etc.

The "Maschinenfabrik Oerlikon" has sent in the claims of this motor, and I hope that it will prove as practicable as my former invention, mentioned above.

The motor can be constructed for any voltage. I have, for instance, lately operated a 6 h. p. motor with 15 volts.

I conclude with a short theory of the motor. I call C the intensity, E the tension of the generator current, R, r the resistances of the field and armature system, L, l, m the coefficients of induction of the two systems, v the angle between the two systems, i. e., the angle between the lines of the points of contact outward and inward, n the number of cycles, n_1, the revolutions of the rotating part. Then we have:

$$C = \frac{E}{\sqrt{\left(R + \frac{m^2 u^2 r}{\rho^2}\right)^2 + \left(pl - \frac{m^2 u^2 p l}{\rho^2}\right)^2}}$$

and the torque

$$D = \frac{C^2 m^2}{\rho^2}\left(p_1 r \cos^2 v + \tfrac{1}{2} p^2 l \sin 2 v\right)$$

Here $p = 2\pi n$, $p_1 = 2\pi n_1$, $\rho^2 = r^2 + p^2 l^2$,

$u = p^2 \sin^2 v + p_1^2 \cos^2 V$.

By these formulas one can see directly the effect upon one variation of v or r, R, l, L, by the position of the outer points of contact or by the regulating resistances R W_1 R W_2. These can be either inductive or ohmic resistances.

Tests of Street Railway Return Circuits.

BY LUCIUS T. GIBBS.

During the past winter it was decided to make a test of the return circuit on the system of the Milwaukee Street Railway Company to determine the loss in power occasioned by the system of bonding and general return in vogue on that road.

The track is, for all but some few miles, laid with 58 and 79 pound girder rails, bonded at each joint with two No. 4 B. & S. galvanized iron bonds, one outside and one inside at each joint. The bonds are simply riveted into the web of the rail and no channel pins are used. Cross bonds connecting the rail bonds are inserted at distances of some 90 feet, tying the four rails together, the cross bonds consisting of 5-16th inch galvanized iron cable. The method of connection at this point is to twist the strands around the bonds and solder firmly.

The lines of this road cross the rivers in some five places, and at these points, all being drawbridges, No. 0000 solid copper wires were run across the rivers sunk in trenches, and connecting to the rails at abutments, the usual plan being to run three wires from abutment to abutment, and one additional wire to the centre of bridge, grounding to the frame and rails.

Supplementary wires were run in certain places on the system, these wires consisting of No. 0000 bare copper, laid in grooved lumber between or on the sides of the track, the groove being afterward filled with a mixture of pitch and tar, and a cover of one inch pine being firmly nailed thereon. At certain intervals this wire was tied to a number of the cross bonds, and, when ending up, tied to some half-mile of bonds. In addition to these supplementary wires, the cross bonds were at short intervals tied to the pipe of the city water works, which pipe runs into the station and is tied to the negative bus bar.

The station is situated on the east bank of the Milwaukee River; running to the west side, upon which tests Nos. 6, 7, 10, 11, 12, 13 and 17 were made, are some four No. 0000 wires laid across the river, tying to the track on the west bank.

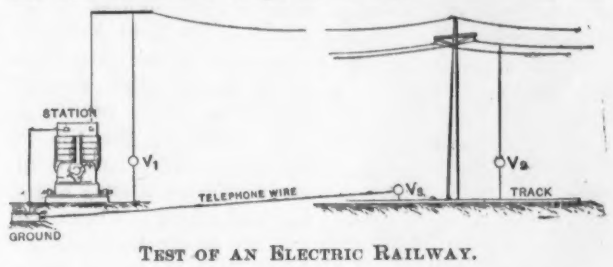
Tests 1, 2, 3, 4, 5, 15, 16 and 17 were made on the south side of the river, which splits some 5,000 feet south of the station, running east and west, thus making these tests divided by another river from the station. The balance of the tests were made upon the east side, the track running at its nearest point some 600 feet from the station, and to which it was tied by some No. 0000 copper wires.

The method of making the tests was as follows: Running on the tops of the centre poles of the system is a metallic circuit private telephone line, the wires of which were used as a potential wire and for signaling over through a hand telephone.

At the power house one man was stationed at the telephone, at which were also a voltmeter reading the station voltage, and a wire running from the negative bus bar. On the line at the point of test was placed a switchboard, hooking to the centre pole and containing thereon a telephone, one voltmeter for reading the line potential, and another for reading the drop or loss in volts incurred in the track.

To connect the voltmeter and telephone, bamboo poles with hooks in their upper ends were used, and hung over the trolley and telephone wires respectively, and a two-way switch was placed on the board for the purpose of making the necessary connections.

The method used was to cal up the power house on the telephone, compare time and arrange at what instant the readings were to commence. The operator at the station then closed the wire running to the negative bus bar on to the telephone wires, thus enabling the



TEST OF AN ELECTRIC RAILWAY.

outside operator to read the track drop. At the instant agreed upon both men read simultaneously.

The voltmeters were corrected for differences in reading, but no correction was made for drop in potential wire. Station, line and track voltages were taken simultaneously. The load in the station between the hours of test will average 2,200 amperes to Dec. 28, 1892, and 2,000 amperes after that date. Twelve readings at each point were taken, and the results averaged. The weather was cold, below 32 degrees Fahr., and snow was present through all tests.

It will be seen that by this arrangement accurate results were obtained, upon which absolute reliance may be placed. The readings were all taken between the hours of 5 and 7 p. m., at the time of the heaviest loads.

It is, of course, impossible to tell by this test exactly what current was flowing through each individual feeder at the instant of reading, but as the feeder system was so laid out as to give a practically uniform drop at all points, the current may be presumed to be fairly well distributed.

The value of such tests as these, while purely local, would point in the direction of securing the best practice in any system. Much dependence has evidently been placed upon the water pipes as a return circuit. This is in any case much to be regretted, as at the best it is but a temporary expedient, as was found to be the case here.

Not more than two years' life in the tie wires used to connect the track and pipes can be fairly counted upon. Extensive electrolysis of both ties and pipes occurs, and the labor of renewal is soon greater than if substantial supplementary wires were first put down. Lead pipes seem to suffer particularly, partly due to their being an excellent conductor and partly from their chemical nature.

In the tests it will be noticed that proximity to the station does not decrease the loss in the track; this is due to an insufficient amount of copper being used to tie the track and station together. In test number 23, which is 500 feet from the station, 13.03 volts were lost in the supplementary wires leading from this point to the station. This is also true of test 6 which is almost directly across the river from the station, showing a loss of 10.20 volts in the return cables.

Some tests on stringer track laid some two years show some curious results, evidently due to broken bond wires. A test made when two cars were running on this stretch showed that when either car took an abnormal amount of current, as at starting, the voltmeter gave readings as high as 100 volts.

The matter of return circuits has been culpably neglected in the past, and it is an evidence of a much better understanding that this subject is now receiving the proper attention due it. It is a very easy matter to lose the full advantages of triple expansion engines and economical station apparatus by the neglect of this very important matter, and a small investment in this direction will give larger dividends than in any other place.

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	General average.
Place	Clinton and Mitchell.	Clinton and Washington.	Clinton and National.	Reed and Park.	Reed and S. Water.	State and Third.	Third and Walnut.	Mason and Milwaukee.	Ogden and Jackson.	Chestnut and Fifth.	Chestnut and Twelfth.	Chestnut and Twentieth.	Third and North.	Third and Hadley.	National and Hanover.	National and Eleventh.	National and Twenty-second.	Farwell and Keene.	Farwell and Brady.	Farwell and North.	E. Water and Chicago.	E. Water and Martin.	E. Water and Oneida.	
Distance	10,800	8,200	7,000	6,000	4,000	1,200	5,000	1,600	3,600	3,200	10,000	13,800	8,400	11,400	8,400	12,300	16,200	6,800	8,500	11,500	3,600	1,000	500	.....
Date	12-21-92	12-21-92	12-24-92	12-24-92	12-24-92	12-24-92	12-24-92	12-27-92	12-27-92	12 31-92	12-31-92	12-31-92	12-31-92	12-31-92	1-3-93	1-3-93	1-3-93	1-6-93	1-6-93	1-6-93	1-9-93	1-9-93	1-9-93	.....
Day	Sat.	Sat.	Sat.	Sat.	Sat.	Sat.	Sat.	Tues.	Tues.	Sat.	Sat.	Sat.	Sat.	Sat.	Tues.	Tues.	Tues.	Fri.	Fri.	Fri.	Mon.	Mon.	Mon.	.....
Time	5:10 P. M.	5:30 P. M.	5:55 P. M.	6:02 P. M.	6:11 P. M.	6:42 P. M.	6:55 P. M.	5:45 P. M.	6:12 P. M.	5:35 P. M.	5:59 P. M.	6:05 P. M.	6:33 P. M.	6:48 P. M.	6:27 P. M.	6:45 P. M.	6:57 P. M.	6:29 P. M.	6:40 P. M.	6:56 P. M.	5:40 P. M.	6:02 P. M.	6:20 P. M.	.....
Average station voltage, V_1	428.8	450.3	448.5	436.2	434.6	446	405	453	435	448.6	482.5	466.7	454.1	460.3	469.3	495	499.8	455	458	496.5	455	425	472.7	455.5
Average line voltage, V_2	340.8	387.1	401.7	332.5	376.6	392.5	342 5	418.8	369.6	422.7	430.4	440	404.5	377.5	427.5	457.5	459	415	399	451.6	428.8	390	403	403
Average line drop ($V_1 - V_2$) $= V_3$	69	49.7	31.9	88.4	42.2	45.5	51	22.6	53.6	18.4	43.1	17	38.2	69	25.8	22.9	21.8	24.8	44	33.3	14.7	27.4	61.6	39.9
Average track drop, V_3	19	13.5	14.9	15 3	15.8	8	11.5	11.6	11.8	7.5	9	9.7	11.4	13.8	16	14.6	16	15.2	15	11.6	11 5	7.6	8.1	12.5
Average total drop	88	63.2	46.8	103.7	58	53.5	62.5	34.2	65.4	25.9	52.1	26.7	49.6	82.8	41 8	37.5	40.8	40	59	44.9	26.2	35	69.7	52.5
Per cent. line drop	16.09	11.04	7.11	20.26	9.71	10.20	12.59	4.99	12.32	4.1	8.93	3 64	8.41	14.99	5.48	4.63	4.96	5 45	9.6	6.7	3.23	6.47	13 03	8.87
Per cent track drop	4.43	3	3.32	3.51	3 64	1.79	2.83	2.56	2.71	1.67	1.87	2.08	2.51	3	3.41	2.95	3.2	3.34	3.27	2 34	2.53	1.79	1.71	2.76
Loss in volts per 1,000 ft. in track	1.76	1.65	2.13	2.55	3.95	6.7	2.3	7.25	3.28	2.34	.9	.7	1.36	1.21	1.9	1.19	.99	2.23	1.76	1.01	3.19	7.6	16.2	3.22

Electricity at the World's Fair.

THE EXHIBIT OF THE GENERAL ELECTRIC COMPANY, LTD., LONDON AND MANCHESTER.

ROM very early in the history of the preparations for the Columbian Exposition it has been apparent that the electrical exhibits from Great Britain would make a poor showing, as regards quantity at least, as compared with those from some of the other foreign countries, and especially with those of the United States. This has been made evident in many ways, chief of which has been the attitude of the English electrical journals, who have even gone so far in some cases as to advise their constituents not to exhibit. Some of the reasons for this are apparent, one of which has been the McKinley tariff, which our British cousins have claimed has been prohibitive to any possible returns which might otherwise be expected from the outlay involved. They have also claimed that in the way of machinery they had many improvements which would only be copied to their detriment were the same exhibited in this country; and while the more candid admit that in many things we are ahead of them in electrical development, still that in the finished product they have less to learn than to teach, and they could therefore not see it to their advantage to go to the trouble and expense which a creditable display would necessarily involve. However we may differ with these views, the fact has remained that agencies have been at work that have prevented a display in the Electricity Building which has been creditable to the English people as a nation, although the individual displays, one of which is our theme this week, is highly so to the enterprising exhibitor, which, notwithstanding these adverse influences, has had sufficient confidence in its own manufactures to bring them in close comparison with the best this country affords. This enterprise is emphasized by the fact that it is almost the sole electrical exhibit from Great Britain in the Electricity Building, and also from the fact that this exhibitor is intending to open an American branch to compete in our own country in the specialties which have made its name so potent at home.

Considerable confusion of names has resulted, not only from the fact that the first part of the title of the English concern is the same as that of our own well known company, but also from the fact that their location is contiguous, and might easily, for this reason, be mistaken as being a part of the American exhibit. The General Electric Company, Limited, of London and Manchester, however, assumed this name as far back as 1884, while the American company did not come into existence until a very short time ago. The two have no business or other connection in common, nor can they be said to be, in the strict sense of the word, competitors, for, while some of the goods manufactured are of a character common to both, still the specialties of each differ widely. Like the General Electric Company of this country, the General Electric Company of London and Manchester is the largest electrical manufacturing company in Great Britain. It has its principal works at Manchester, with its head offices and warehouse in London. Adjoining the works in Manchester, it also has a supply department subsidiary to the London supply house, whence electrical engineers draw their supplies for Manchester and adjacent work.

The electroliers—or fittings, as they are called in England—are all manufactured in London. In addition to these establishments it also has smaller stores at Glasgow and Birmingham.

Although the present name was only assumed in 1884, the business was organized about fifteen years ago, and the company is, therefore, one of the pioneers in the electrical manufacturing business, not only of Great Britain, but of the world. At its organization there were about five employes all told. To-day they have on their payrolls eight hundred at Manchester, two hundred and fifty at London and fifty at Birmingham and Glasgow. The principals of this company are G. Binswanger, Managing Director; Hugo Hirst, Director of the Electric Light Department, and Max Binswanger, Director of the Electric Bell and Telephone departments. These two departments are further subdivided into the electric light plant and machinery, electric light supplies, electric light fixtures and glassware, electric power and traction, electric heating, telephones, electric bells, telegraph supplies and medical electric appliances. The exhibit of this company is located in Sections 3 and 4 of the British Section in the Electricity Building, and occupies an area of 23 by 25 feet. Here has been erected a stall tastefully draped with maroon plush curtains, and decorated with British flags as its distinguishing decoration.

The fittings within are in black and gold, which give a pleasing contrast with the inclosing walls. In the centre of the space arises a pyramid upon which are displayed their leading specialties.

Surmounting the apex of this pyramid is an electric clock, which is deserving of some attention. This involves the patents of Messrs. Binswanger and Coats, the latter being present works foreman of the concern. This is not a self-winding clock in any sense of the word, but supplies the motive power to its pendulum by the falling of a weight which is raised through a small arc during one portion of the stroke by an electromagnet, and which

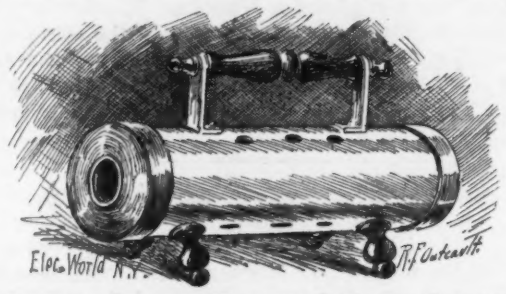


EXHIBIT OF GENERAL ELECTRIC COMPANY (LONDON)—CURLING IRON HEATER.

is short-circuited during the other portion of the stroke. It is intended to insert this mechanism in the ordinary lighting circuits, and for this purpose an extra resistance is supplied for the purpose of cutting down the current which would otherwise flow, though it is intended to manufacture clocks to be operated by battery power as well. The consumption of current is only 1-60 of an ampere, so that the cost of operating becomes at once insignificant. Since the operative parts involve nothing more complicated than the old reliable pendulum, and the variation in current strength has no effect whatever upon the speed of the clock, the latter bids fair to be a strong competitor with existing timekeepers, both as regards simplicity and reliability.

On the faces of the pyramid are displayed the various types of their switches, cut-outs, rosettes, and fuseboards in porcelain, which are decorated in various patterns to match the wall paper and other fittings of the room in which they are to be placed. There are also shown several corridor distributing boards. These consist of slate bases, always in two parts, and insulated from each other by ebonite strips. The slate itself has been specially treated to prevent absorption of moisture, and on its face is handsomely enameled or marbleized. These corridor distributing boards are usually placed in the corridors or hallways of a building, and contain the switches by which the lamps within the neighboring rooms are controlled. They are neatly done up in black walnut or teak, with glass door, and those exhibited provide for the control of from four to six circuits, having as many link switches and double pole fuses as there are circuits controlled.

A cheaper form of distributing fuseboards in porcelain without the switches, for engine-room use and other similar situations, is also shown. Switches of various kinds, many of them of patterns unfamiliar in this country, appear in various designs, and among these are several of the designs herewith illustrated, having a double pole and double brake. In these the two levers which make and break the circuit are actuated by a double link movement, and take in at each of their four ends into jaws, which are provided with screws by which they may be adjusted to provide for the inevitable wear. The link movement seems to be a favorite one with these manufacturers, as it is found in perhaps a majority of their switches, even down to the small switch controlling the individual light. In fact, these link switches form one of the specialties of the General Electric Company, and are said to be among the most popular in England.

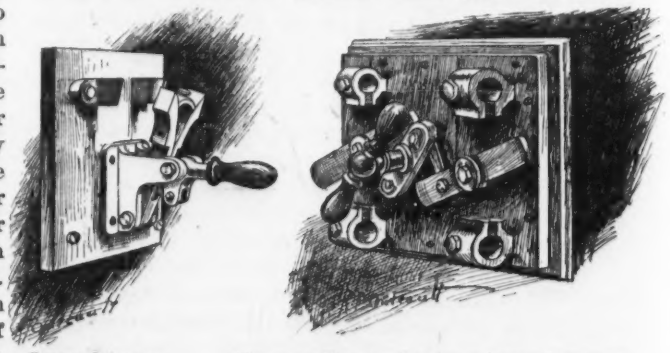
The ladies will find something of interest in this display in the electrical cooking utensils, of which quite a line is displayed. The principle involved in all, of course, is that of heating a small wire which is imbedded in a fire-proof cement or preparation, applied to the portion of the utensil where it will be most efficient.

It is different from some of our American applications of the same principle, in that this preparation, the invention of Mr. Binswanger, is not an enamel, and may be applied cold, and, it is claimed, may be applied readily to any utensils already in use.

And then there is a device which may be even more interesting to some of our lady readers than the electric cooking utensils, and we mention it under our breath. It is nothing less than an electrical device for heating curling irons. This consists of a short metallic tube long enough to take in a full grown curling iron; we give no dimensions, for our lady friends know how long that is. This tube is surrounded with Mr. Binswanger's cement, and in this is imbedded a fine platinum wire coil. The current passes through this wire and heats it, and imparts the heat to the curling iron within the tube. When the proper temperature is reached, of which our aforesaid friends must be the judge, the curling iron is withdrawn, and of what is done with it afterward we can say nothing. We believe we have done our duty when we have told them how to heat their curling iron, and that any further suggestions would be superfluous and would be considered impertinent.

EXHIBIT OF THE GENERAL ELECTRIC COMPANY, LTD., LONDON AND MANCHESTER.

Returning to the cooking utensils, there will be found here pots, frying pans, teapots, coffee pots, saucepans,



LINK SWITCH. DOUBLE BREAK DOUBLE POLE SWITCH.
EXHIBIT OF GENERAL ELECTRIC COMPANY (LONDON).

&c., which for aught we know may have been in use for years, or they may never have been used at all, for they would look equally well and clean after a year's use, as no soot or dirt from the fire can ever reach them. A few of their measuring instruments are also shown, and are of extremely simple design, depending upon the magnetic attraction of an electric current for a segmental iron armature attached to the short end of a lever, the other end of which is the index hand which plays over a

graduating scale. When no current is passing the index hand is moved to zero by the weight of the armature, and, as will be seen, the action of the coil is opposed to the action of gravity upon the iron armature. Certainly nothing could be simpler, and these instruments are guaranteed to be quite accurate. Besides the measuring instruments are seen some specimens of their lamp reducing switches, which consist of a number of resistance coils, enclosed in a metallic case, the ends of which are brought out to a

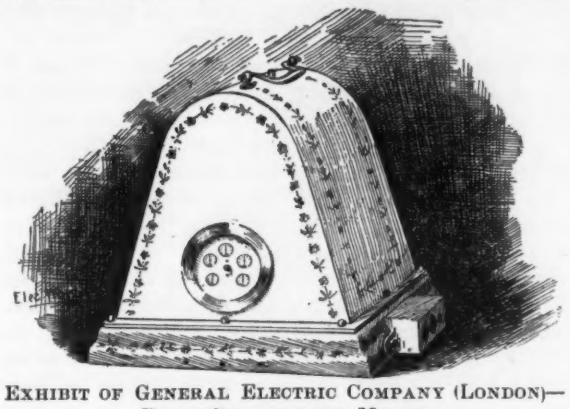


EXHIBIT OF GENERAL ELECTRIC COMPANY (LONDON)—PENTZ-RECKENZAUN METER.

series of contacts, over which plays a lever arm by which one or more of these resistances can be thrown in or out of circuit. These instruments are found in considerable use abroad in hospitals and elsewhere, where it is desirable, at times, to reduce the normal candle power of the incandescent lamp, as in the sickroom. The electrical gaslighters, invented by Mr. Clark, the former manager of these works, and manufactured by this company exclusively, fill the upper panel of the north face of the pyramid. These exceedingly useful implements are very simple in construction, and are based on the principle of the Voss frictional electric machine. The mechanism consists of two cylinders of hard rubber, concentric with each other, the outer one forming a handle; fitting loosely into this is another cylinder which is revolved by a ratchet movement actuated by thumb pressure. This inner cylinder is coated inside with tinfoil, and has on its outer surface at one end a number of small brushes corresponding to brushes on the Voss machine, which bear upon the interior surface of the outer cylinder, which is also coated with tinfoil. The spark which is thus generated passes between two points at the extreme end of the instrument, to which the charge is led by appropriate conductors; thus, it will be seen that there is no consumption of material, and the instruments will, therefore, never become exhausted. This device is not new to this country, as the patents controlling it in the United States were sold some years ago to a prominent American manufacturer. One of the specialties of this company is the principle of high insulation, which is exemplified in all of its earthenware or porcelain switches, cut-outs and connections. This deserves special mention. The bases, and, in most cases, the covers of all of these

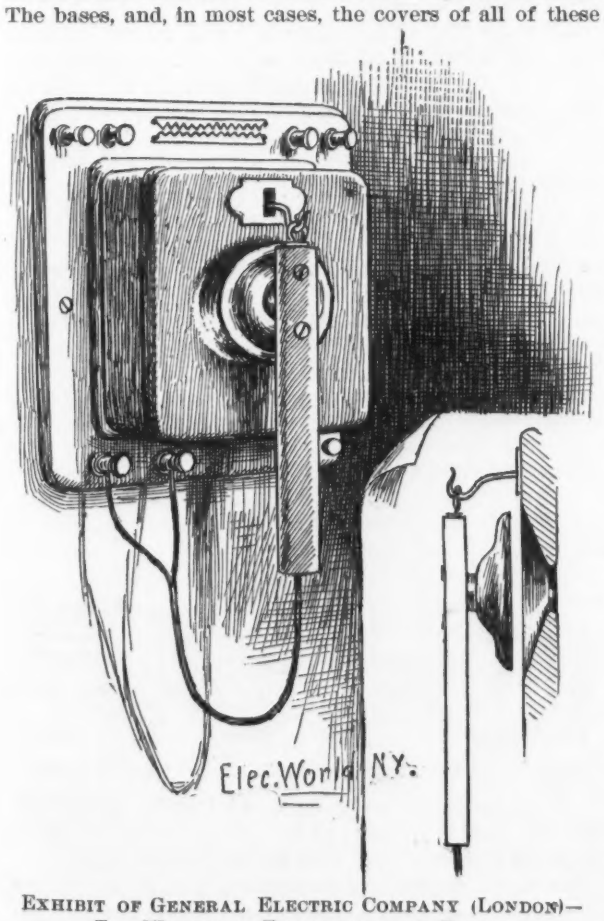
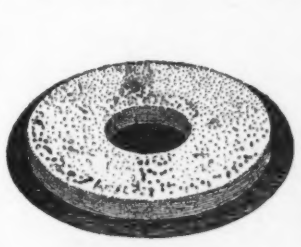


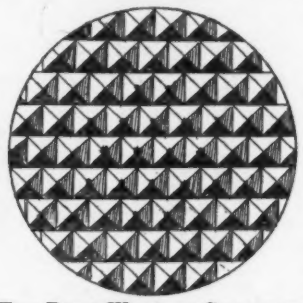
EXHIBIT OF GENERAL ELECTRIC COMPANY (LONDON)—THE WHISTLING TELEPHONE AND DETAIL.

goods are made of a peculiar porcelain, and the opposite poles are invariably separated from each other by a porcelain ridge or prominence to increase the path of any accidental arc. These porcelain bases are tapped with screw threads cut into the porcelain in exactly a similar manner to that which would be adopted were the base of metal, but in no case do the screws extend through to the under side, so that there is no metal on the under side, however many metallic connections there may be on the face; this permits the use of these implements upon damp walls or elsewhere, which would be prohibited or unsafe under other conditions. This porcelain ware is manufactured especially to insure high insulation, and it is claimed that it cannot be duplicated in America. The clay employed is a special one, and it is pressed, not molded, and then turned on a lathe, the drilling and tapping being a patented process. Our attention was called to an exceedingly neat arrangement in the fixing screws, by which the covers and handles of their appliances are attached to the other parts. No one who has handled such things much but has been provoked time and again by the dropping out of a screw when removing a rosette or switch.

The telephone department, which is under the supervision of Mr. Max Binswanger, and which does the largest business in England in the telephone line, supplying the British government, general post office and railway companies, is well represented here by a number of receivers and transmitters, some of which are not much known in this country. The receiving instruments, as here displayed, employ usually a horseshoe magnet instead of the more familiar bar magnet, the two poles of which are brought close together, and around each of which is wound the exciting coil. The instrument itself, instead of being wholly of hard rubber, is of metal, and covered with a sheet of gutta-percha. The cup is wholly of brass, and the seat upon which the diaphragm rests holds a thin zinc ring loosely laid in, and the diaphragm is brought into contact with this by a screw on the metal faceplate. This seems to be the equivalent of our receiving instrument. There are also displayed a number of what are termed watch receivers. These obtain their name from their shape, being somewhat thicker, but not much larger in diameter, than a good sized watch. In this the magnet is also horseshoe in shape, occupying the outer circumference of the box, the two poles being



DIAPHRAGM OF HUNNING TRANSMITTER WITH COTTON CUSHION.



THE REAR WALL OF CHAMBER OF THE HUNNING CONE TRANSMITTER.

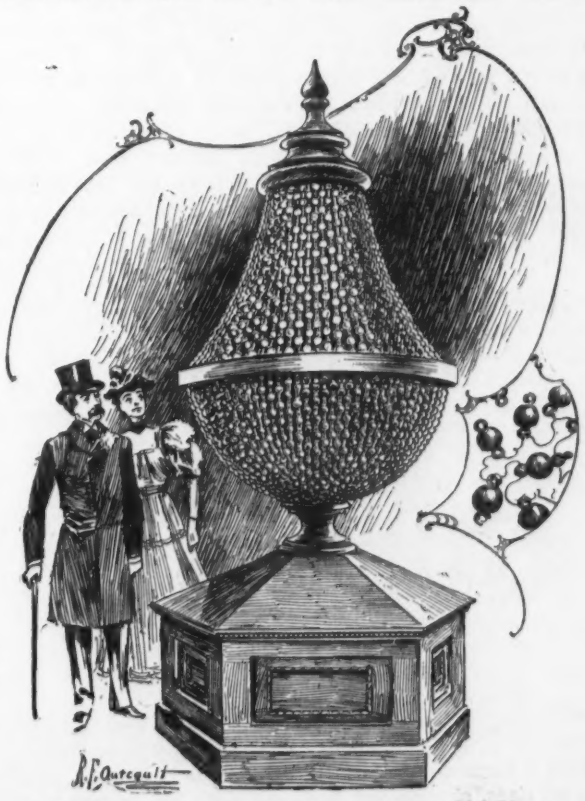
EXHIBITS OF GENERAL ELECTRIC COMPANY (LONDON).

turned in and then upward, so as to be central to the metal diaphragm. The transmitters which are shown are chiefly what are known as the Hunning cone transmitters. In all of these there is a receiving cone in front of the instrument, whose apex, but a little removed from the diaphragm, is covered with wire gauze to prevent the tapping on the diaphragm by means of the finger or lead pencil, which would injure it. As our readers are aware, the Hunning transmitter involves the use of granulated carbon between two upright diaphragms. The objection to the original type was, that after continued use this granulated carbon would compact itself at the lower portion of the chamber, so as not to respond readily to the varying pressure caused by the vibration of the front diaphragm. The one illustrated here has for a back diaphragm a disc of carbon whose surface is made into a number of quadrangular cones or pyramids, which extend nearly across the chamber to the vibrating diaphragm in front. The apices of the 18 central cones are tipped with an elastic nap of some kind, and against these points the front diaphragm partly rests. The elasticity of the nap permits of sufficient vibration of this diaphragm and dampens it sufficiently to suppress the harmonics and other undesirable vibrations. The front diaphragm, which is exceedingly thin and fragile, has attached to its inner surface a ring of cotton wool, leaving the centre entirely bare for contact with the granulated carbon. This diaphragm is held in place by a screw cover, which when screwed home fastens it rigidly in place. The whole transmitter proper is arranged so that it may revolve around its horizontal axis so as to redistribute the granulated carbon whenever through use this becomes necessary, so that, as in the case with the Blake transmitter, when good results are not obtained, the trouble is rectified in this instrument by turning it around through a greater or less angle, so as to redistribute the granulated carbon within. One of the exhibits in this line is what is called the Whistling Telephone, so called from the method adopted for calling a subscriber. The receiving instrument is of the watch type attached to a handle, and is hung up directly in front of the transmitter, which is of the Hunning cone type. A push button is conveniently placed at each instrument by which the battery circuit is thrown on without the removal of the receiver. When one pushes this button the diaphragm of the receiver at the other end is at once attracted, making, we will say, the initial click. This is heard by the transmitting instrument, and telephoned around the circuit to the receiver again, which again responds, causing the transmitter to send a second click, and so on. These separate clicks, as we have called them, give a musical note, corresponding to the rapidity of the clicks. Thus if A wishes to call B, he merely presses the button, and B's instrument responds by a musical note, which is started by the first click, and perpetuated by the mutual action of the transmitter and receiver in close proximity. This phenomenon has been observed before, but it is the first practical application of the same that we remember to have heard of. We are told that when the German exhibit in the Electricity Building is complete an instrument located there will be connected with one in the exhibit of the General Electric Company, and this interesting phenomenon will be shown.

In the centre of the back wall of the enclosure are a number of carbons of all kinds, which are manufactured in great quantities by the firm of which we speak. Another department to which we have referred is that which manufactures what are termed fittings in England, but which we could call fixtures, or electric light fixtures. This department is represented by a number of handsome designs for electroliers and brackets, the most noteworthy of which is one which was specially designed for the late Duke of Clarence. This is intended to represent the solar system. The fixture typifying the sun is immediately in front of the central pyramid of which we have spoken, and consists of an electric drop light and shade. Around the equator of the latter are represented the signs of the zodiac. At other points around the display are located eight brackets, each representing one of the planets. These each consist of an ivory globe, which is the planet itself, and pendent from this hangs a frosted incandescent lamp bulb. There are also many other exhibits of interest in this department which will especially interest the American, from the fact that the designs will be novel to him, and the display as a whole is worthy of study as showing the difference between European and American practice, and is especially interesting at this time, from the fact, as before stated, that this company is contemplating opening an American branch house at an early day, and will bid for American custom. While this may seem somewhat like carrying coals to Newcastle, the General Electric Company expresses confidence in its ability to successfully compete in the American market, in the line of its specialties at least, with the best of our American manufacturers.

THE H. W. JOHNS MANUFACTURING COMPANY'S EXHIBIT.

This firm, so long and so favorably known in connection with insulating materials required by both steam and electrical engineers, has an extensive and well arranged exhibit in section "U," near the centre of the west gallery of the Electricity Building, overlooking the ground floor. The space is surrounded by a neat brass railing, and is marked at the four corners by large white globes, supported by ornamental posts. These globes are surrounded by bands in blue and gold, upon which are printed the name of the company and the cities wherein are situated the principal branches of the New York house, viz., Chicago, Boston, Philadelphia, Atlanta and London. The most striking feature of their exhibit is their illuminated sign, which may be seen from nearly all parts of the building, and which faces the central hall. The letters in this are two feet high, and are outlined in red and white lamps, the two legends being superimposed upon the same board. The white lamps outline the name of the firm, "H. W. Johns Manufacturing Company," while the red spell out the word "Insulation." These



A FEATURE OF THE H. W. JOHNS MANUFACTURING COMPANY'S EXHIBIT.

are flashed alternately by means of a commutator switch operated by a small motor, so as to attract the attention of the visitor.

At the north end of their space is a tasteful pavilion or office, in white and gold, inclosing an area of 12 by 17 feet. A register has been provided, and all visitors are cordially invited to put down their names. Directly south of the pavilion is an urn-shaped arrangement of molded mica globe strain insulators, supported by an oak stand. In this there have been used no less than 960 of

their well known molded mica strain insulators, and the whole forms a neat and handsome display in itself. Arranged around the space are a number of handsome showcases containing various samples of their insulating materials. In the first case are shown samples of asbestos suitable for electrical and steam purposes. Another case is devoted more particularly to vulcabeston, which consists of asbestos fibre cemented together by india rubber and vulcanized under great pressure. In one case are samples showing the various stages of manufacture. The finished product has a smooth and even surface, and, it is claimed, can be molded into any desired shape; such shapes are illustrated, including magnet spools, washers, armature rings and other parts of electrical apparatus, which must be made of insulating material and at the same time possess considerable rigidity and withstand mechanical strains. Another case illustrates trolley line materials insulated with molded mica. This molded mica, as most of our readers are aware, is composed of flakes of mica,

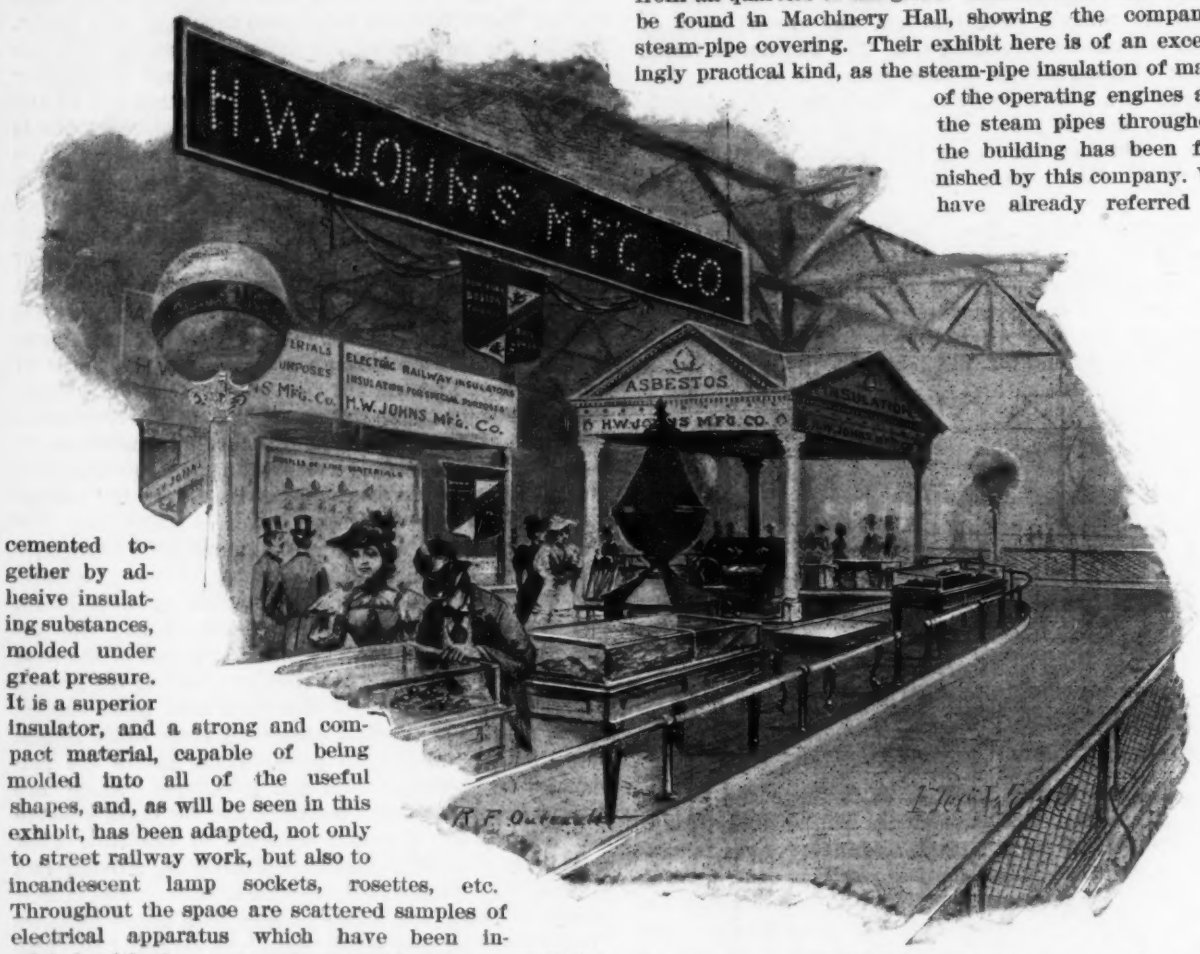


EXHIBIT OF THE H. W. JOHNS MANUFACTURING COMPANY.

cemented together by adhesive insulating substances, molded under great pressure. It is a superior insulator, and a strong and compact material, capable of being molded into all of the useful shapes, and, as will be seen in this exhibit, has been adapted, not only to street railway work, but also to incandescent lamp sockets, rosettes, etc. Throughout the space are scattered samples of electrical apparatus which have been insulated with the company's materials. An opportunity is here offered to inspect the street car controllers of the Westinghouse and General Electric companies, which are insulated exclusively with vulcabeston. A large Gramme ring armature core for an Excelsior dynamo, completely covered with vulcabeston, is a striking example of the flexibility and value of this material for the insulation of armatures and for similar purposes. Monarch insulation is displayed in other cases. This is a material which in some degree possesses some of the qualities of both vulcabeston and molded mica. A large line of vulcabeston gaskets, washers, piston-rod, concave and convex packing rings are arranged in a case by themselves. Several of the packing rings referred to are especially made for the Westinghouse air brake pump, for which

purpose they have proved themselves admirably adapted. On the floor near the office desk is piled a large number of vulcabeston field magnet spools of all sizes, shapes and designs. Near by, in one of the show cases, are similar designs of the same material, comprising small magnet spools, rheostat bushings, etc. In an adjoining case are a lot of commutator rings of various sizes, also made of vulcabeston, and in another near by are displayed a lot of special electrical pieces, showing the variety of shapes and forms and uses to which this material is adaptable. They also show large sheets of vulcabeston, 36 inches square. While one would imagine it a difficult thing to make an attractive display of such homely material as insulating substances usually are, the H. W. Johns Manufacturing Company has succeeded in making an interesting and attractive display, and one that will prove of great interest to the constructing engineer. The material here displayed is manufactured by the Johns-Pratt Company, of Hartford, Conn., of which the H. W. Johns Manufacturing Company is the sole selling agent. In all, the H. W. Johns Manufacturing Company is represented at the World's Fair by six exhibits, distributed among four of the main buildings of the Exposition. The company has two exhibits in the Mines and Mining Building, the principal one being on the ground floor near the centre in the north central section, where their machinery is shown, illustrating the processes of manufacturing asbestos from its crude state to the finished products. The other is in the east gallery of the building, column 11, section T, and shows samples of asbestos ores from all quarters of the globe. Still another exhibit may be found in Machinery Hall, showing the company's steam-pipe covering. Their exhibit here is of an exceedingly practical kind, as the steam-pipe insulation of many of the operating engines and the steam pipes throughout the building has been furnished by this company. We have already referred in

THESE COMMUTATORS AND COLLECTORS
INSULATED WITH
VULCABESTON.
H.W. JOHNS M'F'G CO.
NEW YORK.

The Electrical World to the insulation of the steam pipes in the great Worthington pump exhibit, which was furnished by this company.

A description of the electrical exhibit of the H. W. Johns Manufacturing Company would be incomplete without a mention of the fact that the large Westinghouse dynamos which light the grounds, are placarded with brass plates, containing the announcement that the commutator and collector rings of these machines are insulated with vulcabeston. This the company considers the most valuable advertising feature of its World's Fair exhibit.

Mr. W. F. D. Crane, of the New York house, and Mr. H. A. Reeves, of the Chicago branch of the company, will be in attendance during the summer.

THE OPENING OF THE ELECTRICITY BUILDING.

Thursday, June 1, was set for the formal opening of the Electricity Building—just why, we do not know, but probably for the same reason that May 1 was set for the formal opening of the Exposition in general. While it does not signify that because the building is now "open" it is complete in all its details, yet Thursday evening witnessed the display for the first time of a number of exhibits of a spectacular nature that had not before been shown. The day opened inauspiciously, and while at times the sun shone brightly, there was that constant appearance of impending rain, which deters the more cautious from venturing out, and for this reason, probably, there was at no time as large an attendance on the grounds as have been collected there on other "open" evenings.

The Electricity Building was the central attraction, and Thursday evening saw the greatest throng, which, however, never amounted to a great crowd, that has thus far been gathered within its walls.

The main feature of the evening was the unveiling of the much talked of Edison Tower of Light, which forms the central feature of the Electricity Building. This, together with the exhibit of the Phenix Glass Company, which occupies the pavilion from which the shaft rises, formed the subject of a full page illustration in The Electrical World two months ago—viz., that bearing date of April 8. The huge model of the Edison bulb in prismatic glass, which surmounts the whole, was again illustrated and described in detail in our issue of May 20, and requires no repetition here.

Referring to our original representation of the tower as a whole, some changes have been made in the form of the capital, which is now square and more classical, and some minor changes have been made in the cornice of the pavilion—both changes which are thought to be for the better—but the arrangement of the lights and figures on the shaft has remained unchanged, and, as before stated, were illuminated for the public for the first time on Thursday.

The lamps, which are arranged in geometrical figures, were of six c. p. each and in three colors, purple, orange and red, and these were arranged on numerous circuits so as to permit not only of the separate control of the individual colors, but also of individual groups of lamps in the same and different colors, so as to form different combinations of these and new figures.

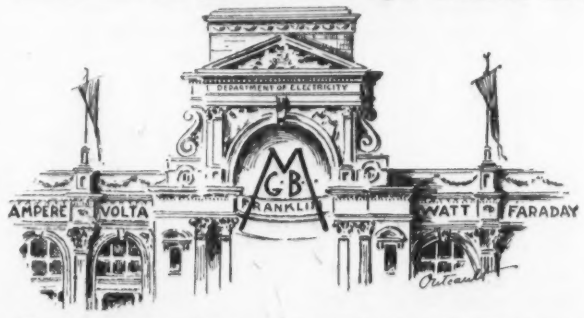
The immense prismatic bulb, though about 8 feet high, really seemed small on its pedestal of nearly 80 feet. This was illuminated from within by a number of incandescent lamps, but was disappointing in not having the brilliancy or even distribution of light which it was hoped might result, and it suffered greatly in contrast with the tower beneath it, when the latter was studded with its vari-colored stars.

At exactly 8:10 p. m. the orchestra, which was stationed in the gallery in the east end of the transept, struck up lively music, and the muslin screens, which so long had hidden from view the object of interest, began to be drawn, and when entirely removed the two searchlights from either end of the transept were first turned on the shaft, which was made to glisten in their rays by the crystalline coating with which it had been prepared.

Then to the tune of Strauss waltzes first the purples were flashed, then the orange, each vertical line in turn being thrown into the circuit and then cut out again in rotating sequence. This was followed by the alternation of the purple and the orange, working rapidly round the shaft from right to left, the shifting of the colors keeping excellent step with the enlivening strains of the "Beautiful Blue Danube." These were followed by the addition of figures—the whites now appearing for the first time, and the kaleidoscopic changes following accurately the rhythm of the waltz music, set the whole audience to keeping time, and then the whole column broke forth into a blaze of glory, to which each of the 5,000 tiny lamps contributed its beautiful mite. The tout ensemble was indeed grand, and met a hearty response in the applause of those present. Then, suddenly, all was gone save the pale flickering of the prismatic emblem above, which had been forgotten in the presence of tiny prototypes when they themselves had sprung to life. The same programme was repeated several times during the evening, and each time to appreciative audiences, and again was brought into prominence the silent vigil which surmounted all and which seemed only called into a sickly existence by the death of those beneath.

While the play of miniature lights in varied combinations was indeed beautiful and striking, it seemed a pity that they were denied a better setting, for the lines of the tower are anything but artistic, and symbolical of anything by courtesy only. We noted the absence of illumination of the capital itself, which should have been the crowning glory of all, but this, which should have been a mass of color, was shown only by reflected light. While in outline this latter is artistically an improvement on that originally planned, the presence of lamps in the original plan, as shown in our engraving, would have more than atoned for its other defects.

The new Westinghouse pavilion, which stands just to the north of the General Electric Company's display, was also illuminated for the first time, and although less pretentious than the great tower of light attracted much



DISTINGUISHED NAMES ON THE ELECTRICITY BUILDING.

attention for its beautiful lines and tasteful design. In this was shown the hand of the artist, and, by those of taste and discrimination, was much admired.

The music played on this occasion was preserved for all time by the Edison phonograph, which listened attentively through an enormous ear trumpet at close range, and those who were denied the pleasure of listening directly to the beautiful strains may doubtless hear them at second-hand from the phonographs that are generously distributed throughout the building.

At the same time there was a musical entertainment of an entirely different kind going on elsewhere in the same building. Under the classic dome of the American Bell Telephone building had been suspended four trumpets to which telephones had been attached. These were connected by the long distance wires with another portion of the city, some eight miles distant, where another

concert was in progress, and the music there rendered was distinctly and clearly heard by those present.

The grounds without were also partially illuminated, but the air was damp and chilly and the crowds preferred shelter. The great dome of the Administration Building was indeed grand, and the long beads of light which outlined the banks of the grand basin and the cornices of the beautiful structures fronting thereon gave a fairy-land appearance to the scene. A single searchlight on the Liberal Arts and Manufactures Building now turned on the classic peristyle threw it out in bold contrast against the black sky; now sweeping along the Agricultural Building emphasized in turn the many groups of figures and dome, and then after striking for a moment the great Palace of Mechanic Arts, it at last rested on the white McMonnies fountain, and there disclosed to view the symbolic and mythic figures which are worthy of preservation in more enduring stone. But the great electric fountains remained dark.

The following communication, signed by Director of Works Burnham, and addressed to the representative of the General Electric Company at the World's Fair, gives the reason for this: "You have called my attention to the fact that many people have expressed disappointment with your electric fountains as played Saturday night last. You are aware that the hydraulic engineers are putting in a new connection, so that the electric fountains will have an independent pump pressure, instead of depending on the general system, now operating all fountains at the same time. Until this is done I do not expect more than the experimental work of last Saturday, nor do I wish you to try the brilliant effects depending on high pressure and quick shutting valves, as this would be dangerous to the pump machinery, until the separate connections, with additional safeguards, are ready. I am informed by the engineers that the special fittings are ordered, and that after they come it will take a week to complete the work. In the meantime, please show set figures and lights on open Exposition nights."

Windmills for Electric Lighting.*

BY GEORGE H. MORSE.

With the introduction of any new departure from existing industrial methods, the following questions must be satisfactorily answered: First, Can this be done? Second, How can it best be done? Third, Will the returns pay a proper interest on capital invested?

The first two of these questions, with reference to the generation and storage of electricity by the use of windmills, have been well answered by the recent experiments of a number of able engineers.

Mr. C. F. Brush, Electrician of the Brush company, has in his private grounds at Cleveland, O., a fine example of an electric wind plant. Neither time nor money has been spared in making this plant a thorough success. A very good description was given in the "Scientific American," Dec. 20, 1890, page 389. The wind wheel, which is of the American pattern, having a diameter of 56 feet, furnishes power to run the plant, which contains 350 incandescent lamps, two arc lights and three electric motors. About 100 of the incandescent lamps are in everyday use. The electricity is furnished by one 1,200 watt Brush dynamo having a speed at full load of 500 revolutions per minute. The dynamo is automatically arranged to be thrown into circuit at 330 revolutions per minute, the electromotive force being limited to 90 volts. There are 408 secondary battery cells, each having a capacity of 100 ampere hours. These cells are charged and discharged in 12 batteries of 34 cells each.

A description of the experiments of Prof. Blyth was given in the "London Electrical Review," and an abstract of the same may be found in the "Electrical Engineer," Aug. 31, 1892. Prof. J. Blyth devised a peculiar form of apparatus in order to do away with some of the inconveniences attendant upon the use of the more common form of windmill.

Quoting from the article mentioned above: "It consists of four hemispherical cups attached to four arms, and moving in a horizontal plane about a vertical axis. From the theory of this instrument (Robinson's anemometer), which is, however, only approximate, it appeared that whatever might be the speed of the wind, the speed of the cups attained a certain terminal value, such that the couple due to the wind pressure was exactly equal to that produced by the resistance to the motion through the air, and the friction on the bearings.

"Last summer I erected a machine of this kind, which has been considerably improved within the past three months. The cups are replaced by semi-cylindrical boxes attached to four strong arms, each about 26 feet long—the opening of each box is 10 feet by 6 feet, and the vertical shaft is a long rod of iron five inches in diameter. At the lower end it carries a massive pitwheel which actuates a train of gearing, and drives a flywheel, six feet in diameter, with the requisite speed for driving a dynamo connected with it by a belt in the ordinary way. This machine worked most satisfactorily, and with a fair wind speed gave about two electrical horse power. I also tested it in a strong gale, by allowing it to run with no lead, and the result was perfectly satisfactory, as a safe terminal speed was attained and all racing avoided. Hence I think that electrical windmills, at least for small installations, are likely to assume this form, as there is no limit to the size and strength with which they may be constructed, and, if necessary, several could be placed in any well exposed position, each having its own dynamo and set of accumulators. During the past few months I have increased the power of the machine by adding an auxiliary box to each arm with a gap between it and the previous one. This I find to be better than merely increasing the size of the previous box."

Two notable experiments upon this subject have been made, in each of which the Halladay windmill has been used with great success. This mill is of the American type, and seems to be a favorite, owing to ease of regulation.

We find in the "Engineer," London, April 1, 1892, the following: "An electrical installation has been made at Messrs. T. E. Carwardine & Co.'s flour mill in the City Road, E. C., and seems to fulfill both the requirements indicated (i. e., storage accommodation and method of regulation)."

One of Messrs. Alfred Williams & Co.'s Halladay windmills, erected on the roof of the building on substantial timber supports, hitherto used for making wheatmeal and working elevators, has been set to drive an Elwell-Parker dynamo, capable of developing a current of about 30 amperes with 70 volts pressure. The windmill drives this at a rate, which, taken with the use of the governor and cut-out employed, is sufficiently uniform to charge a battery of 28 E. P. S. accumulators. From this battery sufficient electricity is obtained for two 1,500-c. p. arc lamps and several incandescent lamps. The windmill consists of a sectional wheel with a vane at the back, the whole arrangement being mounted on a turntable. The vane acts as a rudder and keeps the wheel always facing the wind. The wheel, which is 30 feet in diameter, consists of a skeleton framework, into which a series of wooden sections are centered, and these are connected with counterbalance weights which act as governors and cause the sections to open and shut according to the strength of the wind blowing, thus obtaining a comparatively uniform speed. By means of a sliding contact worked by a governor on the dynamo shaft, the charging circuit of the electrical apparatus is switched on when the speed is high enough, and switched off when it drops too low, and there is also an automatic switch which reduces the existing current when the speed is too high, and thus prevents too much current being forced into the cells at any time. In addition to this there is a resistance in the main circuit which aids the automatic excess switch in its action. The governor controls a lever which short-circuits and opens up resistances which are arranged in the shunt of the machine, and so regulates the electromotive force according to speed."

The following, taken from the "London Electrician," Jan. 20, 1893, forms a sad sequel to the above: "The City Road windmill, which has been used for the electric lighting of Messrs. Carwardine & Co.'s flour mill, besides other work, has been attacked by the County Council as a sky sign, and now the Ecclesiastical Commissioners, as freeholders of the land, have obtained an injunction restraining its further use on the ground that it is an erection contrary to the terms of the building agreement. A rather interesting experiment is thus brought to an end. We understand that the plant gave every satisfaction, the power obtained being sufficient to light the premises with 27 16-c. p. lamps and three arc lights. The storage cells are in excellent condition, and have given no trouble whatever. At the time the injunction was granted, Messrs. Carwardine were about to erect a motor to be driven by the accumulators, for the purpose of hoisting sacks."

Under the patronage of the Duke of Feltre, experiments were made during 1886 and 1887 by the engineer Raoul de l'Angle Beaumanoir at the Cape of the Hague, upon the use of wind power for generating electricity. The experiments were carried out in the most complete manner. The plant was installed in the North lighthouse at Havre, the primary object being a study of the application of electricity, thus obtained, to the economical lighting of beacon lights. During the progress of these experiments, numerous trips were taken upon the Continent and to London for the purpose of studying the wind, and also the best form of windmill, dynamos and accumulators for this use.

A 40-foot Halladay mill was finally selected, a ball governor being substituted for the original centrifugal regulator. This mill was brought to France from the United States, and was guaranteed by the French agent to give 18 force de cheval (17.8), measured on the wind shaft with a wind of 33 feet per second, but was found in reality to give this power at a wind velocity of 23 feet.

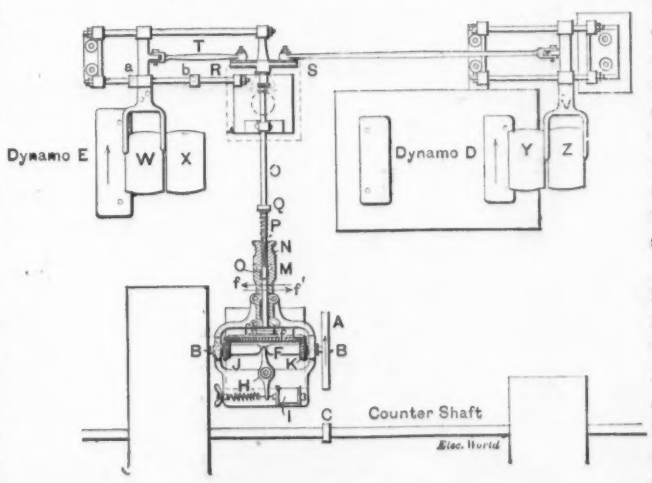
Two dynamos were made by the Brush company at London for the above plant. They were of the Victoria type, each having a normal voltage of 75 volts, one ranging from one to four horse-power, the other from four to 16 horse power. The output of these machines is variable and quite closely proportional to the number of revolutions. The larger machine, while making from 250 to 650 revolutions per minute, has from 40 to 160 amperes. The smaller machine gave for a speed of 100 to 260 a corresponding current of 8 to 40 amperes. The dynamos were arranged to work alternately, according to the power furnished by the mill, the object in having two being to avoid the great loss of efficiency that would occur in any one machine working under such wide variations in speed. Between each dynamo and the series of accumulators were placed automatic circuit breakers.

A most peculiar and original feature of this installation is the automatic arrangement employed to set either dynamo in motion, according to which one is better adapted to the strength of wind blowing. Referring to the figure, A is a pulley keyed to a horizontal shaft B, which is constantly kept in motion (always in the same direction) by means of a belt running from pulley C on the countershaft. A reversing gear F, consisting of a hollow cylinder, slides on shaft B and revolves with it by means of a sliding feather. At its centre the cylinder is turned to a smaller diameter and is embraced by two prongs of a fork, the latter forming the end of a horizontal lever oscillating about the point G. The other end is attached on one side to a spring H, the tension of which may be regulated, and on the other to the plunger I of a solenoid, around which passes a derivation from the circuit of each dynamo.

When the current reaches the maximum strength fixed for the smaller dynamo, the solenoid acts upon the lever, pushing the cylinder F to the left. When, however, the current sinks below this maximum, the spring acts so as to return the cylinder F to the right. On the shaft B are mounted two bevel-gears J and K, each being keyed, not to the shaft, but to one end of the reversing cylinder. If the solenoid prevails in placing the cylinder F, so that the gear J engages with I, it will turn the latter in the direction of the arrow 1, being impelled by the shaft B.

TABLE SHOWING THE COST OF ELECTRIC LIGHTING BY WIND POWER.

Diameter of wind wheel in feet.	Cost of geared windmill, shafting and tower.	Useful horse-power developed. Wind sixteen miles per hour.	Average number of hours this horse-power will be developed per day.	Expense of power, cents per hour. Interest on first cost at 5% per annum.	Depreciation at 5%.	Attendance.	Oil.	Watts recovered from dynamo, 80% efficiency.	Cost of dynamo.	Expense of generating electricity. Interest on first cost.	Depreciation at 5%.	Oil.	Watt-hours recovered from accumulators per day. Efficiency 45%.	Number of lamps, 16 c p., 110 volts.	Number of hours lamps will run per day.	Required capacity of accumulators in ampère hours.	Cost of 56 accumulator cells.	Cost of automatic battery regulator.	Expense of storing the electricity. Interest on first cost.	Depreciation at 20%.	Attendance of plant.	Total expense of obtaining electricity per hour.	Total cost of the eight hours' daily storage.	Equivalent number of lamp hours.	Average cost of lamp hour from wind power in cents.
8½	$153	0.04	8	0.26	0.26	0.06	0.04	14.9	$15	0.03	0.03	0.05	53.7	1	0.84	4	$21	$20.00	0.07	0.28	0.24	1.32	10 56	0.84	12.57
10	164	0.12	8	0.28	0.28	0.06	0.04	44.8	20	0.03	0.03	0.05	161 1	1	2.52	4	21	20.00	0.07	0.28	0.24	1.36	10.88	2.52	4.32
12	177	0.21	8	0.30	0.30	0.06	0.04	78.3	25	0.04	0.04	0.06	279.6	1	4.38	5	27	20.00	0.08	0.32	0.24	1.48	11.84	4.38	3.70
13	181	0.25	8	0.31	0.31	0.06	0.07	93.2	30	0.05	0.05	0.06	335.7	1	5.26	6	32	20.00	0.09	0.36	0.24	1.60	12.80	5 26	2.43
14	227	0.28	8	0.39	0.39	0.06	0.07	104.4	30	0.05	0.05	0.06	376.0	1	5.85	7	37	20.00	0.10	0.40	0.24	1.81	14.48	5.89	2.46
16	301	0.41	8	0.51	0.51	0.06	0.07	152.9	40	0.07	0.07	0.10	550 5	2	4.31	10	54	20.00	0.12	0.48	0.24	2.23	17.84	8.62	2.08
18	350	0.61	8	0.60	0.60	0.06	0.07	227.5	50	0.08	0.08	0.10	1,433.4	5	4.49	26	124	20.00	0.25	1.00	0.24	3.08	24.64	22.15	1.10
20	373	0.79	8	0.64	0.64	0.06	0 10	279 7	60	0.10	0.10	0.30	1,761.9	6	4.60	32	153	20.00	0.30	1.20	0.24	3.68	29.44	27.60	1.07
22	544	1.23	8	0.93	0 93	0.06	0.10	458.8	130	0 22	0.22	0.30	2,890.4	10	4.53	52	249	20.00	0.46	1.84	0.24	5.30	42.40	45.30	0.94
2	584	1.34	8	1 00	1.00	0 06	0.10	199.8	140	0.24	0.24	0.40	3,148.9	12	4 11	57	273	20.00	0.50	2.00	0.24	5.78	46.24	49.32	0.94
30	679	2.40	8	1.16	1.16	0.06	0.13	895.2	175	0.30	0.30	0.40	5,639.8	20	4.42	103	470	20.00	0.84	3.36	0.24	7.95	63.60	88.40	0.72
36	743	2.95	8	1.27	1.27	0 06	0.13	1,1 0.3	210	0.36	0.36	0.50	6,932 2	25	4.34	125	571	20.00	1.01	4.04	0.24	9.24	73.92	108.50	0.68
40	842	4.42	8	1 41	1.44	0.06	0.13	1 648.7	270	0.46	0.46	0.50	10,386.6	38	4.30	190	868	20 00	1.52	6.08	0.24	12.33	98.64	163.40	0.60
50	1,592	6.88	8	2.73	2.73	0 06	0 16	2,566.2	300	0.51	0.51	0.60	16,167.3	60	4.22	294	1,278	20.00	2.22	8.88	0.24	18.64	149.10	283.20	0.59
60	1,902	10.00	8	3.26	3.26	0.06	0.16	3,730.0	400	0.68	0.68	0.80	23,499.0	85	4.33	427	1.857	20.00	3.21	12.84	0.24	25.19	201.50	368.00	0.55



DYNAMO CHANGING APPARATUS.

* Year Book of the Society of Enginecrs, University of Minnesota.

If, however, the spring prevails, K engaging with L will give motion to the latter in the direction of f'.

The wheel L is keyed to a horizontal shaft which carries at its other extremity one part of a clutch M, the other part of the clutch N is mounted on a horizontal shaft O, the extremity of which moves freely in the first half M. The part N is held against the part M by means of an adjustable spring P, pressing against the stop Q. When the two faces of the clutch M and N are pressing against each other, as indicated, the shaft O takes the motion of L, either in the direction of the arrow f or f'. At the end opposite the clutch MN, the shaft O carries two arms, R and S, diametrically opposite each other. The central portion of these arms is cut away to form guides. In the arm R slides a pin attached to a connecting rod T, which moves a forked piece U, the latter traveling upon two fixed cylindrical guides. This fork embraces the approaching side of the belt which drives the large dynamo E. The arm S is attached in the same manner to another fork V, which shifts the belt of the smaller dynamo D. W is the fixed pulley of the dynamo E, and X its free pulley. Y is the fixed pulley of the dynamo D, and Z its free pulley. The arms R and S are so arranged that the dynamo E will be running when D is at rest, and vice versa.

An inclination is given to the teeth of the clutch MN, such that when the shaft O meets any considerable resistance the half N will be forced back upon the spring P, thus freeing O from the motion of L. The resistance referred to is found whenever the forks U or V reach the end of travel, which is determined by the adjustable stops a and b.

The experiments carried on at the North lighthouse have proved very satisfactory, although from a financial point of view the cost of electric energy thus obtained appeared to be rather high owing to the excessive cost of accumulator cells.

In the accompanying table average costs and performance of apparatus, under the peculiar conditions imposed, have been in all cases adhered to.

The dynamo and accumulator plant must have a capacity equal to at least twice the required average, to allow for strong and continuous winds.

Although 50 and 45 per cent. efficiency, respectively, appear low for the above apparatus, yet we should remember that the assumed power of the windmill is to be obtained only under a wide variation in speed.

Electrical Notation, Abbreviations and Symbols.

The American Institute of Electrical Engineers' Committee on the Provisional Programme for the Congress at Chicago, of which Carl Hering is chairman, has issued an appendix to its report covering the subject of electrical notation, abbreviations and symbols. A brief abstract of Hospitalier's paper, read at the International Congress at Frankfort in 1891, is given, and his system is suggested as a basis for an international system to be adopted at the Congress. The table given below embodies these suggestions, and no further explanation seems necessary.

SYMBOLS OF PHYSICAL QUANTITIES AND ABBREVIATIONS FOR UNITS.

PHYSICAL QUANTITIES.	SYMBOLS.	DEFINING EQUATIONS.	DIMENSIONS OF THE PHYSICAL QUANTITIES.	NAMES OF THE C. G. S. UNITS.	ABBREVIATIONS OF THE NAMES OF THE C. G. S. UNITS.	PRACTICAL UNITS.	ABBREVIATIONS OF THE PRACTICAL UNITS.
FUNDAMENTAL.							
Length	L, l		L	Centimetre.	cm	Metre.	m
Mass	M		M	Mass of one gramme.	g	Mass of a kilogramme.	kg
Time[1]	T, t		T	Second.	s	Minute; hour.	m : h
GEOMETRIC.							
Surface	S	$S=L.L$	L^2	Square centimetre.	cm^2	Square-meter.	m^2
Volume	V	$V=L.L.L$	L^3	Cubic centimetre.	cm^3	Cubic-meter.	m^3
Angle[2]	α	$\alpha=\frac{arc}{radius}$	A number.	Radian.		Degree; minute; second; grade.	
MECHANICAL.							
Velocity	v	$v=\frac{L}{T}$	LT^{-1}	Centimetre per second.	cm : s	Metre per second.	m : s
Angular velocity	ω	$\omega=\frac{v}{L}$	T^{-1}	Radian per second.		Revolutions per minute.	t : m
Acceleration	A	$A=\frac{v}{T}$	LT^{-2}	Centimetre per second per second.	$cm : s^2$	Metre per second per second.	$m : s^2$
Force	F	$F=M.A$	LMT^{-2}	Dyne.	dyne	Gramme: kilogram.	g : kg
Work	W	$W=F.L$	L^2MT^{-2}	Erg.	erg	Kilogrammetre.	kgm
Power	P	$P=\frac{W}{T}$	L^2MT^{-3}	Erg per second.	erg : s	Kilogrammetre per second.	kgm : s
Pressure	p	$p=\frac{F}{S}$	$L^{-1}MT^{-2}$	Dyne per square centimetre.	dyne : cm^2	Kilogram per square centimetre.	kg : cm^2
Moment of a couple	W	F.L	L^2MT^{-2}	Dyne-centimetre.	dyne : cm	Kilogrammeter.	kgm
Moment of inertia	K	$M.L^2$	L^2M	Gramme-mass centimetre squared.	$g : cm^2$		
MAGNETIC.							
Strength of a pole	m	$F=\frac{m^2}{L^2}$	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}$				
Magnetic moment	$\mathfrak{M}$	$\mathfrak{M}=ml$	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}$				
Intensity of magnetization	$\mathfrak{I}$	$\mathfrak{I}=\frac{m}{V}$	$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$				
Field intensity	H	$H=\frac{F}{m}$	$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$				
Flux of magnetic force	Φ	$\Phi=H.S$	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}$				
Magnetic induction	$\mathfrak{B}$	$\mathfrak{B}=\mu\mathfrak{H}$	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$				
Magnetizing force[3]	$\mathfrak{H}$	$\mathfrak{H}=\frac{4\pi NI}{L}$	$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$				
Magneto-motive force	$\mathfrak{F}$	$\mathfrak{F}=4\pi NI$	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$			ampere-turn.	A : t
Magnetic resistance (reluctance)	$\mathfrak{R}$	$\mathfrak{R}=\rho\frac{L}{S}$	L^{-1}				
Magnetic permeability (inductivity)	μ	$\mu=\frac{\mathfrak{B}}{\mathfrak{H}}$	A number.				
Magnetic susceptibility	χ	$\chi=\frac{\mathfrak{I}}{\mathfrak{H}}$	A number.				
Specific magnetic resistance[4] (reluctivity)	ρ	$\rho=\frac{1}{\mu}$	A number.				
ELECTRO MAGNETIC.							
Resistance	R, r	$R=\frac{E}{I}$	LT^{-1}			Ohm.	O
Electromotive force	E	$E=RI$	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}$			Volt.	V
Difference of potential.	e	$e=RI$	$L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}$			Volt.	V
Intensity of current	I	$I=\frac{E}{R}$	$L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}$			Ampere.	A
Quantity of electricity	Q	$Q=IT$	$L^{\frac{1}{2}}M^{\frac{1}{2}}$			Coulomb; ampere-hour.	C ; A.h
Capacity	C	$C=\frac{Q}{E}$	$L^{-2}T^2$			Farad.	F
Electric energy	W	$W=EIT$	L^2MT^{-2}			Joule; watt-hour.	J ; w.h
Electric power	P	$P=EI$	L^2MT^{-3}			Watt.	W
Resistivity	a	$a=\frac{RS}{L}$	L^2T^{-1}			Ohm-centimetre.	O: cm
Conductance		$\frac{1}{R}$	$L^{-1}T$			Mho.	mho
Specific conductivity[4]		$\frac{1}{a}$	$L^{-2}T$				
Coefficient of self-induction (inductance)	L	$L_s=\frac{\Phi}{I}$	L			Henry.	H
Coefficient of mutual induction	L_m		L			Henry.	H

The C. G. S. magnetic and electromagnetic units have not yet received special names. They are designated by writing "C. G. S. units" after the formula.

No abbreviations exist.

1. The International Bureau of Weights and Measures has established an important distinction in the notation of "time," according as it refers to the *epoch* (date of time of day), or the *duration* of a phenomenon. In the former the reference letters are used as indices, and in the latter they are on the same line with the numbers; for instance an experiment began at $2^h\ 11^m\ 46^s$, lasted 2 h 15 m 46 s and ended at $4^h\ 31^m\ 38^s$. This method is to be recommended.
2. The distinction between the different units for angles (radians, degrees, minutes, seconds, etc.), and their notation is a matter which ought to come before a Geodetic Congress. No propositions are made here.
3. *N* is the number of windings, *L* the length of the solenoid generating the magnetizing force.
4. Abbreviations to be desired.

A Sensation in Electric Heating.

Advance sheets of the June United States Consular Reports contain a report of a remarkable invention by two Belgian scientists, MM. Hoho and Lagrange, which has recently been patented in Berlin, where the invention excited the greatest interest, it is stated, in electro-technical circles.

The apparatus consists of a glass or porcelain vase, which may be of any size conveniently adapted to the purpose, provided with a lining of lead connected with a strong conductor of positive electricity. The vase is filled to three-fourths its capacity with acidified water. A pair of iron tongs with insulated handles is attached by a flexible conductor to the negative pole of an electrical current generated by an ordinary dynamo. With this simple and inexpensive equipment the following phenomenon is produced.

The electrical current having been switched on, a bar of wrought iron or other metal is taken up with the tongs and plunged into the water within the vase. Immediately the water begins to boil at the point of contact; the immersed portion of the iron rises quickly to a red, then to a white, heat, and emits a stream of brilliant white light. In a few moments the heat becomes so intense that the iron melts and falls off in bubbles and sparks, leaving a clear, glowing surface in perfect condition for welding. The heating process has been so rapid that neither the water nor the end of the bar held within the tongs has been more than slightly warmed, and, the current being switched off, the bar, with its submerged end glowing, may be readily held in the naked hand. If, instead of a bar of metal, a stick of carbon is used, the heat in a few minutes produces detached fragments of amorphous carbon, which proves scientifically that a temperature of 4,000 degrees Celsius has been developed. The rapidity of the heating and the limit of temperature to be reached are easily and accurately governed by the strength of the current employed, so that the whole process is under the absolute control of the operator. During the recent experiments at Berlin the measuring instruments registered a tension of 120 volts and a current of 220 amperes. It was estimated that fully 50 per cent. of the current was directly utilized as heat, whereas the practical limit of such utility has not hitherto exceeded 20 per cent. It is stated by the inventors that by employing a still stronger current a temperature of 8,000 degrees Celsius has been developed. The mechanical importance of this fact will be apparent when it is remembered that this is a degree of heat nearly three times greater than that required to extract iron from the ores, the most refractory of which fuse at about 2,700 degrees.

Divested of all merely technical phraseology and reduced to its simplest terms, the process under consideration may be explained as follows: One of the well known effects of electricity is to separate compound fluid bodies through which it passes into their primitive elements. The current, passing through the tongs and metallic bar into the water, decomposes the latter into its two gaseous elements—oxygen and hydrogen. The oxygen is attracted and gathered on the relatively large surface of the lead lining and produces no noticeable effect. The hydrogen, on the other hand, gathers around the immersed portion of the bar; and, as this has a comparatively limited surface area, it is immediately surrounded with a close envelope or jacket of hydrogen, which, being a bad conductor of electricity, creates a powerful resistance to the passage of the current, and thus develops the heat which causes the bar to glow and melt. It is merely an application of the well known law that friction or resistance to the passage of an electrical current causes heat, and the apparent paradox of a piece of cold metal plunged into cold water rising rapidly to a melting glow is as simply and clearly explained as the incandescence of a platinum coil in a vacuum bulb.

For welding purposes the process is pronounced perfect. The clean envelope of hydrogen which surrounds the heated metal prevents oxidation, and the welding surface is left free from the effects of sulphur and other impurities, which are always present when iron is heated by a coal fire in an ordinary forge. The quality which entails the largest possibilities, and which has been as yet only superficially investigated, is the capacity of this process to heat quickly and to any desired temperature the end or submerged surface of a mass of iron while the remainder of the mass is left cool and comparatively unaffected by the heat. It is believed that this may lead to important results in the hardening and tempering of armor plates and other objects in iron and soft steel in which great resistance to penetration or abrasion by friction is requisite, while preserving the interior tough and fibrous to resist concussion or strain, as in many parts of machinery. At Essen, Messrs. Krupp & Co. are experimenting with it in the hardening of steel cannon; and it is believed that in chemistry this method of producing an intense and easily regulated temperature may lead to the successful manufacture of diamonds, rubies and sapphires through the production of the larger forms of crystallized carbon.

Whether it is applicable as an electrolytic process to the reduction of metals seems to be disputed. One ac-

count claims that by it the cost of refining gold, platinum, copper, nickel and even iron will be reduced 80 per cent., while other authorities assert that, though metallic oxides may be successfully reduced by this method, no other foreign substances contained in the metal will be eliminated by it. In any event, however, the discovery of the principle that has been already demonstrated must open a wide and interesting field of research to the electricians of all countries.

An Automatic Printing Speed Counter.*

BY GEO. S. MOLER.

The printer (see Fig. 1) is essentially a speed counter which prints the speed at the end of each minute upon a strip of paper and does this continuously, requiring very little attention.

The worm of the counter is connected to the shaft to be recorded so that it revolves at exactly the same rate. The type wheel is about 8½ inches in diameter, and the type are spaced so as to correspond with the number of teeth of the large gear wheel which engages with the worm. The printing is done upon a one-half inch tape of district telegraph paper. A typewriter inking ribbon is employed and it takes several weeks to go once the length of the ribbon.

The type wheel practically starts from its zero reading at the beginning of each minute. It is necessary to have it do this, in order that the number printed at the end of the minute shall be the exact number of revolutions for that minute.

The apparatus acts as follows:

The type wheel, which is held by friction on the shaft, and is carried with it, is at the beginning of the minute slipped backward or forward until it has the correct relative position, then for the remainder of the minute revolves at the same rate as the large gear wheel on the same shaft. The method of slipping the type wheel around is partly shown in Fig. 2. The toothed wheel a, driven by the bevel gear, revolves once for every 30 revolutions of the main shaft. The plate or arm b revolves with it, when the pawl c is allowed to catch in the teeth of the wheel. As the plate b goes around with the wheel, the pin d overtakes the arm e, which is attached to the type wheel, and pushes it along, slipping the type wheel on the shaft. When b has made one complete revolution, the pin f on the pawl c comes opposite a notch, not shown in the figure, into which it is pushed by a spring, thus pulling the pawl from the wheel, and also holding b stationary. It takes 30 revolutions of the worm to carry the plate b around, it coming to rest just at the end of the thirtieth revolution. If at this instant the printing hammer were allowed to act, the number 30 would be printed, but if it does not strike till the end of the minute the type wheel will move with the large gear wheel till that time. The striking of the hammer releases the pin f, and the pawl which has a spring of its own is again brought in contact with the teeth and so carries the plate b around again. If the type wheel should complete its revolution before the pin d overtakes the arm e, then the arm e comes against another pin, which stops it, until the pin d does overtake it. This is the slipping backward which has been mentioned. If the printer should be driven too fast, so that the type wheel makes a revolution before the minute is up, or if the hammer is not caused to act for several minutes, then it will, the next time it acts, print a zero, which is the type under the hammer while the wheel is held stationary.

The hammer is released at the end of each minute by means of an electromagnet operated by a clock, and when the hammer makes its stroke it opens a switch in the electric circuit while the contact in the clock is still closed, so in this manner the spark, on breaking the circuit, is made at the switch, and not at the clock contact. The hammer is set again by a pin on the side of a wheel coming in contact with a lever, and this closes the switch again before the next contact of the clock. When the machinery is not running the switch remains open, and so the battery materials are not consumed in useless work.

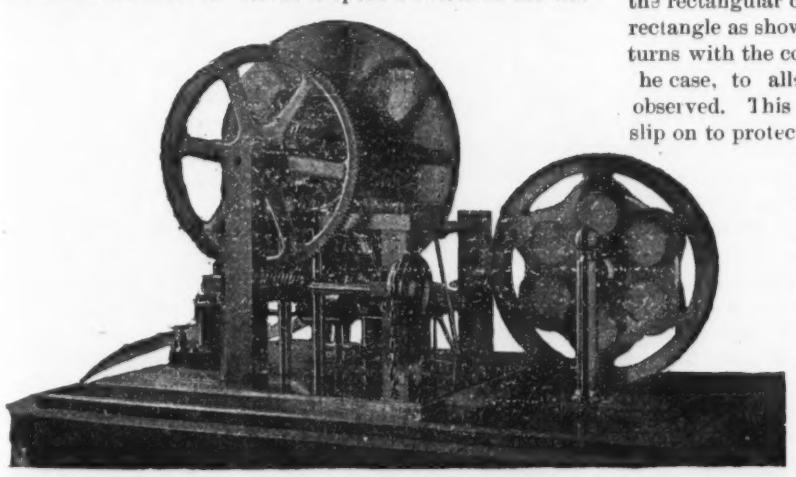


FIG. 1.—SPEED COUNTER.

The numbers move past a stationary point which prints its position upon the paper when the hammer makes its blow. If the number printed is exactly opposite the point, then there has been a whole number of revolutions that minute, but if the number is above or below it the fraction indicated by its position can easily be determined. Fig. 3 shows how the fraction of a revolution appears on the record. An exact number, 145, is shown at (a), 145.25 at (b), 145.5 at (c) and 145.75 at (d). Usually enough of either the preceding or following number is printed to easily make it out, and estimate the fraction, which can be read to one-fifth of a revolution.

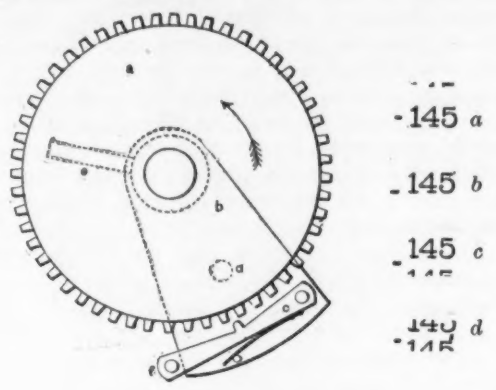


FIG. 2.—SPEED COUNTER.

* Abstract of a paper read at the Tenth General Meeting of the American Institute of Electrical Engineers.

A Modified Deprez-D'Arsonval Galvanometer.*

In the first portion of this paper Lieut. C. D. Parkhurst discusses the relative merits of reading the reflecting galvanometer deflections by means of a lamp and scale and telescope and scale, and strongly favors the latter. He then proceeds to describe the well known D'Arsonval galvanometer. He states that a modification of the ordinary galvanometer was made by him, the U-shaped magnet being dropped completely through the base so as to project below its lower surface sufficiently to allow the lower tension spring to be mounted on the under side of the base, where it could be reached at any time to adjust the tension of the suspension. This was necessary on account of the fixed brass cover which enclosed the instrument and shut off the light, except from the front. The leveling screws of the base were made long enough to allow the tension spring screws to be easily reached.

One great objection, Lieut. Parkhurst states, to this galvanometer is the fact that it is not readily portable, and while it is admirably adapted to all kinds of measurements of the utmost delicacy and will stand considerable handling without injury, yet there is much to be desired to render it absolutely portable. The Weston voltmeter and ammeter to a certain extent obviate this difficulty, these instruments being the simple D'Arsonval galvanometer in another form. Although they are extremely accurate and can be used for all kinds of measurements, yet, as they are read by index and not by mirror, extreme refinement of reading is impossible. With a view to meeting this requirement the following instrument has been devised, and is now in process of construction. It is shown in detail in the accompanying illustrations, Figs. 1 to 5.

The magnet is made circular and compound with soft iron pole pieces, similar to the arrangement in the Pitkin form of D'Arsonval instrument; but in place of the wire suspension of that instrument the steel pinion and pivoted centres of the Weston form, with the double hair springs, are adopted.

The coil may be the flat coil of the Pitkin instrument, or it may be the rectangular coil as generally used. If the flat coil is used the mirror can be attached to the coil; with the rectangular coil the mirror frame is set within the rectangle as shown; in both cases, of course, the mirror turns with the coil. A window, as shown, is provided in the case, to allow the movements of the mirror to be observed. This window can have a brass cap or cover to slip on to protect the glass in transportation.

The bottom and top of the case are of hard rubber, the side of the case is thin brass tubing; in the case, in the space within the bend of the magnet, a set of shunt coils may be inserted, with terminal blocks on the top of the case; the binding posts are upon the top, and a short circuit may be provided as shown.

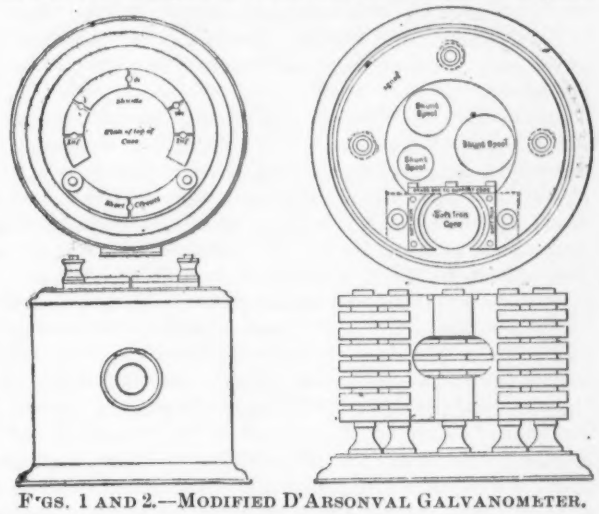
Where the rectangular coil is used, an iron core can be still put in inside the frame of the coil, being cut away as shown to allow the mirror to have room to swing. This really makes this iron core in two pieces, yet it contains a large mass of iron, and helps to strengthen the field of force in which the coil swings; the field of force is kept symmetrical by the shape given to the pole pieces, so that the lines of force are evenly distributed from front to rear, and the coil remains in practically a constant field during its entire swing. The cutting away of the poles each side of the mirror is to allow the scale to be still reflected from the mirror after large deflection.

We then have a neat, compact and readily portable instrument, whose readings should be as fine and delicate as one may desire. Since the beam of light weighs nothing, and can be made almost as long as one chooses, within reasonable limits, it should be evident how greatly the scale is magnified, and how fine and close the readings may be.

Galvanometers with indices must have a very finely graduated scale to read closer than one-fourth of a degree; the average will not read closer than one half degree; fine readings are, therefore, impossible as a certainty, particularly when the tremble and quiver of a finely poised needle and index are considered. The Weston instruments are of this class, and, although they can be closely read by estimation, we are not certain of the reading, though perhaps we can read close enough for the general work for which they are used.

With a mirror, scale and fine reading telescope we have an index that is imponderable, and about as long as we choose within reasonable limits. The scale being graduated to millimetres, is easily read at a distance of 3,000 scale divisions, a little over 10 feet; the writer has frequently used a telescope at a distance of 12 feet, the distance being only limited by the size of the room, and not by any difficulties in reading the scale.

At this distance, then, a deflection of one millimetre, easily accurately read, means a tangent of $\frac{1}{3000}$ or .000333, corresponding to an angle of about one minute of arc, and, as this is the tangent of twice the actual angle of displacement of the mirror, we see that the mirror has actually moved about one-half minute only.

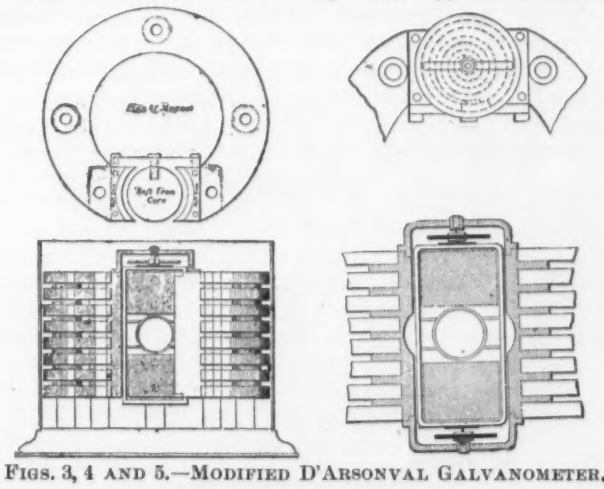


FIGS. 1 AND 2.—MODIFIED D'ARSONVAL GALVANOMETER.

We can read this small angle positively; by estimation we can read one-half of a scale division, or our scale can be graduated to half millimetres, and we can read that deflection positively; hence, we see that we can read down much finer and with more positive exactness than can be done by any other method, a movement of the mirror being visible in the telescope that could hardly be detected with the unaided eye, and that would be imperceptible if an index had been used.

In conclusion, the writer says that he hopes the modifications of the instrument as described may be found of value and use. So far as he knows they are original, and are not protected by any patents; any one should be, therefore, free to construct and use such instruments, and if any one so does and gets as much satisfaction from their use as has been his good fortune, the writer states that he will be fully satisfied.

Lieut. Parkhurst then calls attention to the necessity of some action to induce instrument makers to be more complete with the data that are furnished for their instruments, since such data can only be accurately determined during the process of manufacture. Careful and permanent records thus made would oftentimes enhance the value of the instruments far more than the additional cost would amount to. This is especially applicable to the various makers of the tangent galvanometer. He has often seen more than one fine standard galvanometer of Western Union pattern about which no definite information as to the number of turns of wire in each coil or their mean radii were obtainable. Similarly Helmholtz-Gaugin instruments were lacking in the same data, these two being high grade instruments costing from $125 to $175 each.



FIGS. 3, 4 AND 5.—MODIFIED D'ARSONVAL GALVANOMETER.

In foreign, and particularly German instruments, all these data are generally given together with centimetre scales properly arranged to measure the distance of the centre of the coil from the centre of the needle when the coil is moved away from the needle to another position, but in this respect there is apparently no uniformity with American-made instruments.

* An abstract of a paper read at the Tenth General Meeting of the American Institute of Electrical Engineers.

THE ELECTRICAL WORLD'S DIGEST
OF
CURRENT TECHNICAL ELECTRICAL LITERATURE.

(Compiled from the principal foreign electrical journals.)

BY CARL HERING.

ELECTRO-PHYSICS.

Radiation from Geissler Tubes.—The "Elek. Zeitschrift," May 5, contains an abstract of a paper by Mr. Angstroem in which he describes a method of measuring the radiation per second per unit of length in gram-calories. He finds that for a given gas and pressure, the radiation of positive light is proportional to the intensity of the current; the composition of the radiation, however, is constant and independent of the current. When the pressure of the gases is increased the total radiation for the same current increases, with small pressures slowly and with increasing pressures more rapidly; at the same time the composition of the radiation changes as the ratio between the intensity of the radiation of short wave lengths to the intensity of the total radiation diminishes. The intensity of the total radiation must be considered as a secondary result of the discharge, and depends on the molecular constitution of the gas. The radiation is no true function of the temperature of the gas.

Condensers.—The "Elek. Zeitschrift," May 19, contains the first part of an article by Mr. Sahulka on the application of condensers in alternating current work. He treats first of the condensers in series and next in multiple arc with a self-induction, from a theoretical standpoint giving very simple formula for the relations. It appears to be well written and is of a practical nature. In the series connection he proves that the difference of potential of the combination may be lowered and the phase difference annulled, the current and energy remaining the same: also that in parallel connection the current may be diminished, the phase difference annulled, the difference of potential and energy remaining the same as if no condenser were used. He also states that a condenser in parallel acts to convert a weak current of small phase difference into a strong current of large phase difference, and vice versa; or in other words it acts as a transformer of current into phase, or vice versa.

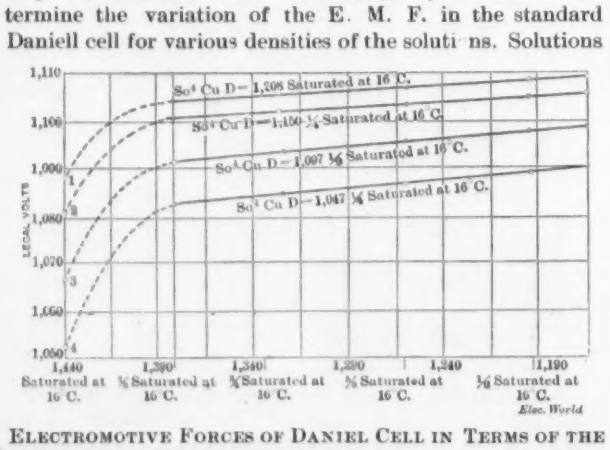
Multiplying the Frequency.—Mr. Korda, in a note read before the French Academy of Sciences, reprinted in "L'Ind. Elec.," May 10, gives the theory of a new method for tripling the frequency without increasing the speed; it consists essentially of placing several coils in different positions on the armature.

MAGNETISM.

Magnetic Viscosity.—The Lond. "Electrician," May 19, reprints a Royal Society paper by Messrs. Hopkinson, Wilson and Lydall, which is intended to supplement the experiments of Messrs. J. and B. Hopkinson published last year; the object is to show whether a certain difference was due to a true time effect or whether it was due to the instrument. It contains a number of diagrams of connections, curves and tables, describing the experiments and the results. The conclusions are: That after a sudden change of magnetizing force the induction does not attain its full value at once, but that there is a slight increase going on for several seconds; that the small difference between the ballistic curve of magnetization with complete cycles and the curve determined with a considerable frequency is a true time effect, the difference being greater between a frequency of 72 and 5 than between 5 and the ballistic curve.

UNITS, MEASUREMENTS, INSTRUMENTS.

Standard Daniell Cell.—Mr. Roux, in "L'Ind. Elec.," May 10, describes some interesting experiments to determine the variation of the E. M. F. in the standard Daniell cell for various densities of the solutions. Solutions



ELECTROMOTIVE FORCES OF DANIEL CELL IN TERMS OF THE DENSITIES OF THE SOLUTION.

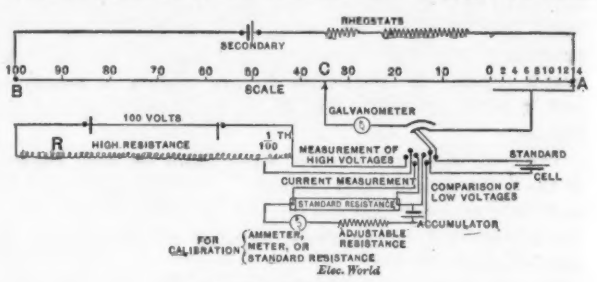
saturated at 16 degrees C. were first made and then diluted with 1, 2, 3, etc., volumes of water. The experiments were made with the Fleming form, in which, however, sheets of the metals were used in place of rods in order to obtain more surfaces, as he believed that the small surface was a case of error; another more simple construction was also used in which one solution was contained in a tube open at the bottom, where it was capped with a porous diaphragm; this tube was then immersed in the other solution; the copper, after being electroplated, was allowed to remain several hours in the electroplating solution in order to allow it to oxidize slowly, thus avoiding the variation in the E. M. F., which may otherwise be as much as 1 per cent. The results are shown in the adjoining figure, which will explain itself; it will be noticed that the E. M. F. is a linear function between certain limits, and that it varies rapidly when the zinc solution approaches saturation The slightest variation of temperature changes the degree of saturation quite materially, and therefore has the same effect as an addition of water. For very weak solutions of the sulphate of zinc very variable results were found. He finds that it is very difficult, even with the greatest of care, to obtain results with the Daniell cell differing less than 1 per cent. In the second portion of the article he gives curves for the specific resistances of sulphate of zinc and copper solutions at various densities and temperatures; the measurements were made with the Foussereau method, the solutions being in a glass tube one metre long. For sulphate of zinc the specific resistance was a minimum at a density of about 1.25.

Photometric Standard.—The Lond. "Elec. Rev.," May 19, mentions that the Paris Academy of Sciences has lately had under consideration the new standard of Mr. Henry, made of phosphorescent zinc sulphide; the quantity of light emitted is within wide limits, which correspond with the luminous saturation, independent of the distance of the exciting agent (burning magnesium), of the time of illumination and of the thickness of the layer; the law of the loss of luminosity of this substance is invariable even when the substance is prepared by different chemists; but the initial intensity may vary. He expresses the law as follows: $i^m (t + c) = k$, in which $m = .598$ and $c = 28.35$. Further details may be found in the "Comptes Rendus," vol. 114, p. 98.

Measuring the Difference of Phase Between Two Currents.—In a note read before the French Academy of Sciences, Mr. Korda describes and gives the theory of the following method: A coil placed in a rotating magnetic field and rotated synchronously with this field has no current induced in it, the field diagram (representing the magnetic intensities) being a circle; if, however, one or the other of the conditions ceases to exist, more particularly if the field intensity is represented by an ellipse, a current will be induced in the coil having a frequency of double that of the field. This principle is made use of to measure directly the difference of phase between two currents without knowing their intensities or their frequency. If a rotating magnetic field is produced, say by a Gramme ring having two windings or between one or two pairs of coils perpendicular to each other and excited by the two currents in question, and coil is rotated by means of a synchronous motor, the ends of which are connected to an electromometer, dynamometer or a telephone, no current will be produced if the two currents are equal and the difference of phase is 90 degrees; the results will be the same if the two components of the rotating field be separated; the latter permits one to vary the angle which the two fields make with each other by turning around a common axis one of the exciters with respect to the other. For a difference of phase and a difference in the currents the field intensity will be represented by an ellipse, and the angle between the coils will be a supplement to the angle representing the difference of phase. If the two currents are not alike, their effects may be made equal by relative displacement of the two coils; for instance, by turning one coil around a diameter perpendicular to the axis. Having thus turned the coils and having displaced their relation to each other until the coil has no current induced in it, the difference of phase will be the supplement of the angle which the two coils make with each other. This applies to sine currents; but if they are not so and do not differ very much from a sine function, the adjustment is made for the position where the least current is induced in the test coil, the current being in that case not zero. The note is reprinted in "L'Ind. Elec.," May 10, and in "L'Elec.," May 13.

Copper Voltameter.—In the Lond. "Electrician," May 19, Mr. Blount, under the heading of "The Accuracy of the Copper Voltmeter," reviews the results obtained by Dr. Ottel, contained in a paper recently published in the "Chemiker Zeitung." The article contains considerable matter of interest, and should be read in full by those specially interested in the subject. Using platinum electrodes and a current density of .0084 ampère per square inch of cathode surface, the copper deposit ranged from 73.9 to 89.2 per cent. of that when copper electrodes were used. It is thought that hydrogen peroxide and specially persulphuric acid (HSO_4) are generated; the use of a small anode as compared with the cathode favors the formation of persulphuric acid and therefore a loss of copper; the suppression of the peroxidized body at the anode can be effected by the addition of formic acid when the yield of copper will rise to 93.7 to 99.6 per cent. of the theoretical amount; or even better, by the addition of alcohol, which is more active, in which case 99.5 to 99.9 per cent. of the theoretical amount is obtained. The observations cast a doubt on the accuracy of the ordinary copper voltameter in which both electrodes are copper, at least when used with an acid electrolyte; the usual prescription insists on the necessity of using a neutral solution of copper sulphate in spite of the high resistance. The conclusions of the long series of experiments by Dr. Ottel are that an acid solution of copper sulphate containing alcohol gives results which agree with those of standard copper and silver voltameters. With a current density below .0193 ampère per square inch and a neutral solution, the ordinary copper voltameter gives false results, the weight being unduly increased by the presence of imperfectly reduced copper in the form of cuprous oxide in the deposit; this does not take place with an acid solution containing alcohol. He gives the following proportions, which he has found most effective: 15 grammes copper sulphate, 5 sulphuric acid, 5 alcohol, in 100 grammes of water, current density .0039 to .97 ampère per square inch of cathode. Mr. Blount adds that voltameters of precision are more preferable used with an atmosphere above the electrolyte of an inert gas like nitrogen. By giving attention to these precautions a substantial advance in accuracy would be obtained.

Potentiometer.—The Lond "Electrician," May 12, gives a description of a new instrument devised by Crompton, the arrangement of which is shown in the accompanying illustration; a plan and elevation of the complete instrument are also given in the original. The diagram will explain itself; the instrument is intended for those who desire to have a complete system of electrical measuring apparatus of a high degree of accuracy; all the three electrical quantities are reduced to a voltage and then



POTENTIOMETER.

compared to a standard Clark cell. The scale wire A B is only $\frac{1}{80}$ part of the whole potentiometer wire; its resistance is about two ohms, while that of the total wire is 30 ohms; it admits of an accuracy of one part in a thousand. The article also illustrates and describes a form of water-cooled resistance for strong currents, consisting of a U-shaped sheet of manganin kept cool by a continuous flow of water. One capable of measuring currents up to 2,000 or 3,000 ampères is contained in a cylinder about 10 in. in diameter and 18 in. high.

Meters.—In the "Elek. Echo," May 20, Dr. Lietje mentions that he has patented a device by which it becomes known if a magnet is brought near a meter with the intention of diminishing the amount of current registered, and that such a device is now used with the Aron and the Schuckert meters; no description, however, is given.

DYNAMOS, MOTORS, TRANSFORMERS.

Prevention of Sparking.—The Lond. "Electrician" and "Elec. Eng.," May 19, reprint an Institution paper by Mr. Sayers "On the Prevention and Control of Sparking; Continuous Current Dynamos Without Windings on the Field Magnets and Constant Pressure Dynamos Without Series Windings." The paper contains 11 diagrams and a number of tables, and is well worth reading in full by those specially interested. The invention consists of additional windings on the armature, and is thus editorially described in the "Electrician": "Broadly speaking, it permits the windings of the series turns on the armature instead of on the field magnets, and hence a series dynamo on this principle requires no field winding and a compound one only shunt coils. This end is attained by connecting the main loops of the armature to the commutator bars by means of long connections, which form open circuits excepting when in contact with the brushes, then they carry the whole armature current. These connections are doubled upward with reference to the brushes and form loops under the edge of the flux pole, thereby producing a forward field, and consequently tending to excite the magnets. By this means it is apparently possible to control sparking, to reduce magnetic resistance and consequent exciting power and also to raise the weight-output efficiency." The paper met with great enthusiasm from the members; but the "Electrician" thinks that its value is overestimated and that the design of direct current dynamos will not be revolutionized or even radically altered by it; however suitable for small machines, it may not be adapted for large ones; one of the peculiarities is a large variation of pressure for extremely small alterations of lead; it is claimed that probably motors embracing this new feature will be utilized in traction problems and assist in solving some of the speed regulation difficulties. The following is a short abstract of the paper: He gives a series of cuts showing the currents at the brush contact in the ordinary and in his dynamo for successive positions of a complete cycle. He states that some believe that sparking is due generally to an abnormal current being generated in the coil which is short-circuited under the brushes; this he believes is far from being true and gives his reasons; he calls attention to the reversal of the potential in the short-circuited coil; if for a given load there is no sparkless position it is because the short-circuited coil comes mechanically into the circuit with too little or no current in it or, in a very bad case, even with the current still in the wrong direction, or in other words, the reversal has only been completely effected or not effected at all; sparking which cannot be gotten rid of by shifting the brushes forward is due to the current of the coil being too small when the break occurs. He calls attention to the effect of the driving pins on the armature, whose position he says will invariably be found to be marked at the commutator by their action on the sparking; to overcome this

he suggests widening the corresponding commutator bars or using a false bar in those places. His machine is illustrated diagrammatically and is accompanied by full construction data, curves and tables of results; these machines are said to be absolutely sparkless. (The arrangement is interesting, but as most of the first-class dynamos built in this country are nearly, if not quite, sparkless, there would be little gain, unless it is in the output or some other feature.)

Alternate Current Motors.—In our issue of April 22 an abstract is given of Mr. Dobrowolsky's reply to the claims of Mr. Brown for the invention of his motor. Mr. Brown has sent a lengthy reply which, for want of space, can be given here in abstract only. It is to a great extent personal, and is largely a repetition of statements which he had already published. He deals chiefly with his claims of being the first one who constructed the practical motor. Aside from the claims of priority there is little of interest to the general public. Mr. Brown has certainly done very good work as a constructor, and his abilities as such are universally recognized; his claims are chiefly that he has made a practical commercial success of his motors, and which, he claims, others have not yet been able to do; he does not appear to claim to be the inventor of the underlying principles, but merely that he has improved the construction so as to produce a practical motor; there seems to be little doubt that the motors constructed by him are practical and commercial motors. He claims that the small motor originally constructed by Dobrowolsky is a proof of the well known fact that a small motor does not necessarily mean that a similar large one would be a success. The improvements which he claims to have made in the Dobrowolsky motor and which he says are essential improvements are the use of laminated iron in the armature (containing the secondary circuit); he also claims to have pointed out the importance of a low magnetic resistance; his motors have been running with 100 and even 140 "alternations" (presumably a frequency of 50 to 70). He asks why it is that if this motor was invented by the earlier claimants, it is not already introduced in large numbers, and he claims that he has overcome the objections which existed in those motors. (He makes no mention, however, of the fact that there is little commercial use for a motor in this country that will not operate with the frequencies universally used here.) In reply to Dobrowolsky's challenge he states that he is not yet ready to publish all the details of his motors, but he is now making a series of tests with frequencies of from 40 to 60, which he promises to publish soon.

Since writing the above Mr. Brown's reply has been published in full in the "Elek. Zeitschrift," May 19, where it is followed by a reply by Mr. Dobrowolsky and a subsequent reply by Mr. Brown. The two latter are to some extent personal and refer to the question of priority; they are of little interest to the general public. Mr. Dobrowolsky concludes that the hesitancy of Mr. Brown to accept his challenge is an admission on Mr. Brown's part; his small motor, referred to by Mr. Brown, did give as much as 6 h. p.; as a proof that the theory was understood before Brown's publication he cites Swinburne's article published in 1889, and his own (Dobrowolsky's) congress paper in 1891.

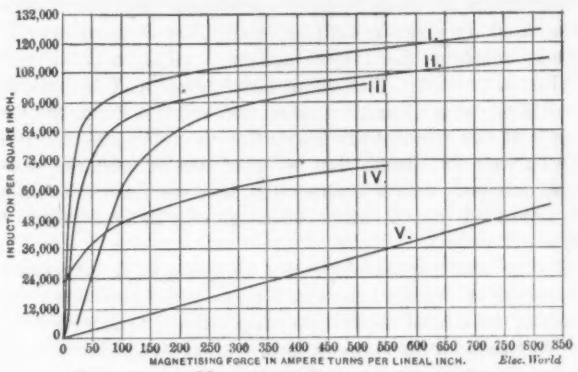
Alternators in Parallel.—See paragraph under Yorkshire station.

Series Wound Traction Motors.—In the first part of an article in the Lond. "Elec. Rev.," May 12 (presumably of American origin), Mr. Dallas describes a number of practical points in the construction of such motors; it is based on American practice. He gives the saturation curves for wrought iron and for mitis metal, the latter showing a permeability of 90 per cent. of the best wrought iron; cast steel, he says, is superior to mitis metal in some respects as sounder castings can be obtained; some grades of low Bessemer steel have a higher permeability than wrought iron. In two like armatures, one having brass heads and the other iron heads, the former will show smaller core losses and will have a higher speed; the torque is the same and the efficiency higher; he gives two curves for two different speeds, showing the core losses in watts for different magnetizing forces; these curves show two knees of opposite curvature; 100,000 lines per square inch with mitis or steel, he says, is a good saturation to use. The torque in foot-pounds may be calculated as follows: Total Kapp lines × convolutions on the armature × 7.04×10^{-6}. He gives two speed curves, one a good one and the other a bad one. To accelerate the speed the T. H. Co. put their motors on what is known as the loop; he gives some data for a motor, as also comparative curves for the loop and the full field connections.

Transformer Design.—The first part of an article by Mr. Weekes is given in the Lond. "Elec. Eng," May 12. It is written in the style of a text book with but little mathematics. Although containing nothing new it is very well written. In giving the results of Dr. Fleming's late test he adds five new columns of deductions of some interest, showing the percentage of magnetizing current and iron losses in each case and also some figures relating to regulation.

In his second article in the issue of May 19 he gives a few formulæ for calculating the amount of copper, the losses, constants; also some rules. In speaking of the cooling surface he states that oil was formerly used for insulation purposes, but that its action as a cooling agent is at low voltages the more important of its properties. He gives curves showing the watts lost per pound of iron and the permeability, with varying induction. He suggests the following order in making designs: First fix the iron and copper losses, then fix roughly the dimensions of the iron and calculate the weight; from the iron loss and the curve determine the induction, from which and the cross section determine the total flux, thence the number of turns required in each winding; from the main length of a turn determine the diameter of the wires from his formulæ, also the weight from the assumed copper loss. It will then usually be found necessary to alter the iron circuit slightly, as also other modifications. He proposes to work out designs for a six-kilowatt transformer of three different types to explain the above method.

Field Excitation.—Mr. Snell's serial in the Lond. "Electrician," May 12, is devoted to the calculation of the field excitation and to special points in designing motors. He gives simple formulæ for calculating the field excitation both for open circuit and for full load (including compound windings). He gives the following useful set of curves shown in the accompanying cut, which will explain themselves. I. is for annealed Swedish charcoal plates from 22 to 24 B. W. G.; II. wrought iron forgings; III. cast steel; IV. gray cast iron, all three as used for field magnets; V. air (abscissæ to be multiplied by 20); all the readings have been determined from the mean of the ascending and descending curves of magnetization. He also gives formulæ for calculating the torque and other data regarding motors.



CURVES OF MAGNETIC INDUCTION IN IRON.

Rudder Motors.—The Lond. "Elec. Rev.," May 19, gives a short description of a paper reprinted in the "Jour. Roy. United Service Institution" for March, describing an electrical system for operating the rudder of a vessel from a distant point as used on several Italian vessels; also an indicator by means of which the operator (on the bridge) can see at any moment the movement of the rudder; the description is somewhat meagre.

Alternate Current Fan Motors.—The Lond. "Elec. Eng.," May 19, in a trade note illustrates the small Meston motor and fan.

RAILWAYS.

Railway Motors.—See paragraphs under series traction motors and sparking.

INSTALLATIONS, CENTRAL STATIONS, ETC.

Lighting of Railroad Trains.—The Lond. "Elec. Eng.," May 12, reprints a paper by Mr. Haes (read at New South Wales) which is mainly a detailed description of a new plant recently installed in Southern Australia. In reviewing the subject he states that one company in England has now between 20 and 30 trains lighted electrically. In England alone up to May, 1891, 365 cars and 57 vans were electrically lighted, and since then this number has greatly increased. He reviews the five different systems, the one mostly used in England consisting of accumulators alone, charged at the terminals, while the one used most frequently in America consists of accumulators in conjunction with a dynamo. A sixth system used in England for lighting the train when it passes through a tunnel, consists essentially of a third rail from which, together with the other rails as return, the lighting current is led to the train by sliding contacts, the generator being in a station near the tunnel. The description of the Australian installation is given in detail, including a view of the dynamo and three diagrammatic cuts, one of them showing the complete connections; the arrangement, though apparently very complete, appears to be quite complicated, but perhaps not less so than is necessary for automatic action in every respect; the generator is a Brush shunt wound machine; it is driven from the axle of a bogie truck; it is fixed to the floor of the van, the driving belt passing from the axle pulley up over two idle pulleys above the dynamo and thence down to the dynamo, the idle pulleys being suspended on springs to keep the belt tension constant for different positions and movements of the truck and the car; all the pulleys are flanged. The governing is effected by means of a horizontal ball governor which not only connects the dynamo to the circuit when the speed is sufficiently great, but also shifts the brushes for varying speeds. The lights are run from accumulators carried in the van whenever the dynamo speed is too low, but whenever it is sufficiently great it charges the accumulators. The dynamo may be revolved in either direction, the field current being reversed for a reversed direction of running; link leather belts are preferred; a resistance is automatically switched into the lamp circuit when the dynamo charges the accumulators. All the various operations of switching in and out the dynamo current, the exciting current, etc., are performed automatically, and in this respect this system seems to be quite complete although somewhat complicated. The wiring of each car is divided over two branch circuits, so that in case a main fuse blows only half of the lights will be extinguished.

From a note in "L'Ind. Elec." May 10, it appears that electric train lighting has proved to be quite a success in France, where a number of the largest railroad companies are introducing it.

Installations in Explosive Surroundings.—The Lond. "Elec. Rev.," May 19, gives a summary of the rules used by the British inspectors of explosives. Among other things they say that arc lamps may not be used; incandescent lamps should be protected by at least one strong outer glass globe so proportioned in size that it shall not exceed 140 degrees Fahr. in temperature. In specially dusty and dangerous areas the outer globe should contain distilled water or should be perfectly sealed by elastic washers, liquid joints, etc. If water is used "one side of the globe should be painted to prevent the concentration of the sun's rays" (presumably to prevent the globe from acting as a lens and thereby setting fire to any inflammable material that may be situated at the focus of such a lens). In other dangerous places it is considered desirable that the lamps and wires be external to the building and accessible only from the outside. Further rules are given which space does not admit repeating here.

Central Station Economy.—With a view to economize generating expenses a London central station offers its workmen a bonus of 10 per cent. of the difference between the present cost and that which is actually the cost of production of this quantity of electrical energy. The same principle has already been introduced with great success in large firms in England.

Yorkshire Station.—The Lond. "Elec. Rev." and "Elec. Eng.," May 19, describes this station at Leeds, which has recently been opened, for 300 h. p. and three alternators. The description includes internal views of the station, the conduits, transformers and fuses. The Lowrie-Hall system is used. It is claimed that this system is the only one in England in which it is the regular practice to run alternators in parallel; each alternator has its separate engine and exciter, and is driven with ropes. One of the chief features is the Gay paralleling device, which, however, is not very well described; its object is to avoid the total failure of the supply in the event of an accident to any one of the units which are running on the bus bars; he arranges a system of fuses between the dynamos and the bus bars as a whole and the various sections of the bus bars, so that in the event of an accident the auxiliary fuses blow before the main cut-outs can, leaving the latter to perform their legitimate duty of protecting the individual machine from an excess of current; the auxiliary fuses form the connecting link between parallel and non-parallel running, and when they act the machines are left running non-parallel. A test showed a consumption of coal slack of 2.45 pounds per indicated h. p., 8.6 pounds of water evaporated per pound of coal, or 21.11 pounds evaporated per indicated h. p.

Muelhause Central Station.—"Electricity" (Lond.), April 28, gives an illustrated description of this accumulator station. The illustrations include a number of cuts and diagrams of the accumulators and several diagrams of the connections.

Installation "Olympia."—"L'Ind. Elec.," May 10, describes this new installation in Paris, the description being chiefly devoted to that of the Willans high speed engine, of which a cross-section is given; the engine is praised very highly in this article.

Central Stations at Locle, Lucerne and Bellinzona.—"L'Ind. Elec.," May 10, gives a short description of each of these stations, the latter two of which are run by water power.

WIRES, WIRING AND CONDUITS.

Copper Steel Wire.—The "Elek. Echo," May 20, contains an article giving tabulated and comparative data of a compound wire made of a steel vein and a copper envelope, showing its advantages in tensile strength over copper wire and in greater conductivity over iron wire.

Underground Cables.—The Lond. "Elec. Rev.," May 12, in a note illustrates an underground cable which had been buried for six months in damp soil at Calcutta. The insulation had been pierced by the root of a native grass which has sharp, needle-like points; the root passed almost diametrically through the cable. The insulation was made of india-rubber and was not armored.

TELEGRAPHY AND TELEPHONY.

Accumulators in Telegraphy.—The "Elek. Zeitschrift," May 19, reprints in full an interesting but lengthy paper by Mr. Strecker. After giving a brief history of the subject, he describes in detail the large installation at present in use in Berlin, in which accumulators are charged by an ordinary copper-zinc primary battery: a diagram is given showing the arrangement of the various circuits so as to obtain different voltages and current strengths from the same battery, also the measuring instruments used; this installation has been in very successful operation for 10 months. Among other advantages such an arrangement increases the speed in cable telegraphy as the charge of the cable takes less time; the accumulators take up less space and require less attention than their equivalent in primary batteries. He gives in great detail calculations of the first cost and cost of running this large station with (a) copper-zinc batteries alone, (b) with accumulators charged by these batteries on the one hand, and (c) charged from the lighting station on the other hand, and, lastly, using thermo-

piles: omitting the latter system, the cost of operation of which is about equal to the second system (b) but less satisfactory, nor as practical, the prime costs of the three systems are: (a), $3,500, (b), $1,125 and (c), $1,750; the yearly costs of operation are: (a), $1,800, (b), $850 and (c), $375 respectively; the station has 270 lines and requires 170 kilowatt hours yearly on the lines; considering the cost of the paper tape, the oil and other material consumed in the telegraph apparatus, a saving in the cost of power is but a small percentage of the total running expenses. He also gives similar calculation for similar stations, for which he concludes that charging by means of primary batteries is preferable to taking the current from a central station; he discusses the use of dynamos for charging the accumulators but does not recommend it. A single primary cell was found to cost 14 cents per year for maintenance; the average current for a line is .0009 ampère; measurements showed that the consumption of copper sulphate in these batteries was eight times the theoretical amount, and that of the zincs was 23 times the theoretical amount; when used for charging the accumulators these figures became 1.12 and 1.22, showing a very great economy when the batteries are so used; in this installation, the large central telegraphy station in Berlin, 170 accumulators charged by 1,000 primary cells are used in place of 12,770 primary cells.

Telephone Conversation Meter.—"Electricity," London, describes and illustrates an apparatus recently patented in Germany for recording the length of the conversation of a subscriber, indicating also the time from the commencement of the call until the time of connection. It consists essentially of a strip of paper moving at the rate of two millimetres per minute divided into spaces representing an hour each; an ink writer is put into action during the time that the telephone is used.

Telegraphing to Trains.—The "Etienne" system recently tried in Algiers, and mentioned before in these columns, is referred to briefly in the Lond. "Elec. Eng.," May 19; every case occurring in practice was tried and was successful; no description is given.

Telegraphy in the West Indies.—Dr. Anderson, in the Lond. "Elec. Rev.," May 12, continues his article on this subject. It is of commercial rather than technical interest.

ELECTRO-CHEMISTRY.

Modified Leclanché Cell.—A new patented cell is described in the "Elek. Zeitschrift," May 12, intended more particularly for microphones. The carbon consists of a cylinder made of dense carbon, having a perforated bottom and top, and filled with the usual mixture of retort carbon and pyrolusite. It is suspended from the top of the jar so as to leave a space below it in the jar for the products which are formed and which in crystalizing will therefore not come in contact with the carbon; the zinc rod dips into a small cup of mercury at the bottom of the cell, the mercury being covered with a layer of sand. The zinc is said to remain free from the deposit of crystals. The other advantages are those usually claimed for improved Leclanché cells.

Accumulators and Primary Batteries.—See paragraph under telegraphy.

Electric Production of Aniline.—A note in the Lond. "Elec. Eng.," May 19, refers to a process described in the "Rev. de Chim. Ind." and in the "Moniteur Ind.," May 9, giving some data.

Electric Production of Baryta.—A paragraph in the Lond. "Elec. Eng.," May 19, describes briefly the process of Mr. Taquet for producing baryta electrolytically and its application for extracting sugar from molasses.

Electrolytic Chlorine and Soda.—Mr. Andreoli, in the Lond. "Elec. Rev.," May 12, continues his attack on the reports of various experts on the Richardson-Holland process. The object appears to be to throw doubt on a number of statements made in those reports; he also points out some important errors in published statements.

MISCELLANEOUS.

Lightning Rods.—Major Pescetto's paper (see Digest, May 6) is concluded in the Lond. "Elec. Rev.," May 12. He summarizes certain rules, some of which, however, are not indorsed by other authors. These rules are briefly as follows: All parts from the point to the exit must be made of the same metal; joints and sharp bends should be avoided; copper is useless and iron has advantages over all other metals; the form of section is not important; conductors should be made of many fine wires distant from each other; from 200 to 250 mils in diameter is sufficient; the discharge will divide itself over all possible passages and many others considered impossible; there should be a good, deep earth besides the connection to mains; the conductor must be connected to any adjacent mains to protect them; neighboring gas and water pipes should be metallically connected to each other; avoid the vicinity of small fusible pipes near the lightning wire; gas and water pipes should not enter into powder magazines unless the structure is metallic; high points on roofs should be avoided; numerous points are better than a few; all external projections should be metallically connected; any insulated bodies may give off sparks; absolute security can be obtained only by inclosing the structure with metal, including the pavement; an entirely metallic magazine needs no earth; in ordinary houses it is well to insulate the lightning rod from the wall, to diminish the chance of a lateral discharge (Prof. Lodge differs). Chimneys may be used for insulations to protect the masonry. An economical way for ordinary houses is to run galvanized telegraph wire all along the corners, ridges and chimneys and bury the end in the earth in a heap of coke; connecting a metallic roof or other large surface diminishes the violence of the shock by virtue of its capacity. Prof. Lodge recommends earthing all metallic parts without uniting them to the conductor. There is great difficulty in determining what objects should and what should not be connected to the rod; tops of chimneys should be arched by the conductor; the rod should be external and visible; one that is distant from the building is better than one in contact; the best protection for a powder magazine is to inclose it in an earthed metallic cage having points and to line it internally with another metallic cage having a separate earth connection. He concludes that lightning rods at present do not give absolute security and that it is difficult to obtain such security. Where absolute security is necessary, regardless of cost, as in powder magazines, it may be obtained by the method of Maxwell.

Electro-culture.—The Lond. "Elec. Rev., May 12, recommends an article on this subject in the "Jour. d'Agriculture Practique," April 6, 1893, by Mr. Pabst. It appears to be a good summary up to date of what has been done in the application of electricity to agriculture and horticulture. Experiments are cited to show that where daylight is supplemented by electric light at night, the development is greatly accelerated, flowers are more richly colored and the leaves greener. Natural atmospherical and terrestrial electrification produces nitrates and nitrites from the nitrogen of the atmosphere which fall upon the soil and enrich it; this he thinks can be produced by artificial electrical storms. (Such compounds, however, can probably be produced much more economically in the ordinary chemical ways.)

Cost of Electric Cooking.—Mr. Dowsing in a communication to the London journals, May 19, gives some data regarding the cost of electric cooking. He calls attention to the fact that for short operations coal is expensive owing to the waste before and after the operation. The electric oven, he says, is heated to 400 degrees in 15 to 20 minutes at double the cost of gas or coal, and by allowing 25 per cent. of the original current to maintain the heat, the electricity will cost twice as much as gas or coal to heat the oven, but only half as much to keep it going. He heated such an oven to 400 degrees F., and took readings for two subsequent hours, at the end of which time the temperature was still 250 degrees, and he concludes from this that the cooking during those two hours would not have cost a single cent. (He appears to forget, however, that the opening of the doors and the introduction of large cold, moist masses will very materially cool the oven.) A large size electric toaster to toast two rounds of bread in one minute, taking 7 ampères at 100 volts, making all allowances, including three minutes for coming to its full heat, he finds will cost less than two cents for about ten minutes, the price per kilowatt-hour being 10 cents. The electric broiler will broil four chops or six cutlets in ten or twelve minutes using 6 ampères; allowing three minutes to heat up the plate and 12 minutes running, the cost is three cents; to boil a quart of water requires about 3½ ampères for 10 minutes, or allowing 15 minutes, it costs one cent, which he thinks is quite as cheap as a spirit stove. Considering the attending advantages he questions whether the expense is in excess of the cost of coal.

Inductoscript.—The Lond. "Elec. Rev.," May 19, page 606, mentions this instrument as one of the exhibits at the Royal Society. It is a method of reproducing figures and pictures by the electric discharge. The original design or object is laid in contact with an ordinary photographic plate placed upon a sheet of metal; a discharge is passed for a fraction of a second between the object and the metal plate, the photograph being then developed in the usual way; bromide paper can be used; the best results were obtained by discharging in oxygen at about two atmospheres pressure.

Towing by Electricity.—The Lond. "Elec. Eng.," May 19, describes briefly experiments made with the De Bovet system, mentioned before in these columns, in which the grip between the driving gear and the towing chain is produced magnetically. With the old chain weighing 20 lbs. per metre an adhesion of from six to six and one-half tons was obtained, and with a new chain of 34 lbs. to the metre it is thought 10 tons would be obtained, or twice the attractive power of the present service on that part of the Seine; the energy to excite the magnet was 3 h. p.

The American Institute of Electrical Engineers.

At the regular meeting of the council held May 16, 1893, the following associate members were elected: F. F. Barber, San Francisco, Cal.; A. Barth-Bartoshevitch, Allegheny City, Pa.; W. C. Bryant, Bridgeport, Conn.; James Burke, Schenectady, N. Y.; J. A. Cabot, Cincinnati, O.; A. F. Christmas, Johnstown, Pa.; J. H. Craig, Boston, Mass.; M. I. Da Cunha, Para, Brazil; T. B. Doolittle, Boston, Mass.; Henry W. Frye, New York City; C. E. Gifford, Buffalo, N. Y.; G. H. Guy, New York City; C. A. Lieb, New York City; J. G. Lorrain, London, England; C. P. Matthews, Ithaca, N. Y.; T. J. W. Olan, New York City; W. M. Petty, New York City; Fred. Sheffler, New York City; G. C. Sonn, Newark, N. J.; A. E. Wiener, Schenectady, N. Y.; Peter Wright, Philadelphia, Pa.; V. H. Yarnall, New York City.

The Student Course at Lynn.*

BY JOHN R. PITMAN.

Application for entrance as a student to the Expert Department of the General Electric Company at Lynn, Mass., is made on a blank furnished for that purpose, and which is required to be filled out with the applicant's name, age, residence, present occupation, experience, references, etc. It will be found of great assistance in gaining admission if the application is accompanied with several letters from prominent men. Upon reflecting that there are now over seven hundred applications on file, and that an average of four is received every day; also that the total number of students allowed in this department at one time is only one hundred, it will be realized that it is no small matter to gain admission; but one need not be discouraged by these figures. It is a rather curious fact that the applications are much more numerous in the fall than during any other season of the year; owing, probably, to the fact that many college men prefer a little rest after graduation before entering upon their lifework. College men from all parts of the United States are gathered here, one might say from the whole world; as England, Germany, France, Russia, Spain, Norway, Japan, Australia, Mexico and several other countries are represented. Unless one is a college man, or has served on the apprentice course, it is a very difficult thing to obtain admission, and it is becoming more and more so every year. Fully 85 per cent. of the men are college graduates. As one cannot become an expert if under age, the Apprentice Course was started in August, 1892, as a sort of preparation school. Since then, however, the department has come under the same head as the Expert Department, and is known as Student Course No. 2. One may enter this course if over seventeen. The work is somewhat mechanical in its nature, but there is enough electricity thrown in, however, to make it interesting. Two years spent at this kind of labor is considered good preparation for the Expert Department.

The Expert Course was inaugurated in 1886, and at that time there were enrolled about ten men, receiving in the neighborhood of $8 per week; the idea being to educate engineers to be of practical importance to the Thomson-Houston company. There was no scheduled course, and every man was guaranteed a position with the company.

At the present time the corporation does not promise to give the students a position upon their completing the course, but many of them get one, nevertheless; and to those that do not, the certificate received proves a valuable assistance at the doors of other companies.

A few days after sending in an application a communication will be received stating that the application has been placed on file and will be given due attention. In time, if the application receive favorable action, a letter will order the applicant to report for work at 6:30 a. m. on a specified date. It is a good plan to reach Lynn a few days before the date on which one is ordered to report. This gives time to get settled in convenient quarters. Valuable information about rooms, board, etc., may be obtained at the office of the Expert Department.

The first morning, one must report to the person who hires all the men employed in the factories. He is given a number, and sent off in tow of a small boy, to the department to which he has been assigned, and which, in all probability, will be assembling railway motors, the dirtiest and most monotonous work in the whole factory. Let us now take a look at the work required in the course:

EXPERT COURSE AT LYNN FACTORY.

	Weeks.
1. *Shop Plant.*	
1. Wiring	4
2. Shop motors	2
2. *Arc Department.*	
1. Arc lamp assembling	2
2. Arc lamp testing	4
3. Arc machine assembling and testing	5
3. *Incandescent Department Direct.*	
1. Incandescent machine assembling and testing	4
2. Meters	2
3. Winding armatures	4
4. *Stationary Motors and Generators.*	
1. Assembling and testing	4
2. Railway and large generators	5
5. *Alternating System.*	
1. Machine assembling and testing	5
2. Constructing transformers	2
3. Testing transformers	2
4. Testing mining drills and apparatus	2
6. Railway motor testing	3
7. Blacksmith shop	2
	52

In addition to the above, experts are required to do more or less work of an experimental nature, such as testing special machines, etc. In return for this labor one is reimbursed as follows: For the first three months, five cents per hour; for the second three months, seven cents; for the succeeding three months, ten cents, and for the remainder of the year, twelve cents per hour. If one should remain on the course for more than a year he is paid at the rate of fifteen cents per hour.

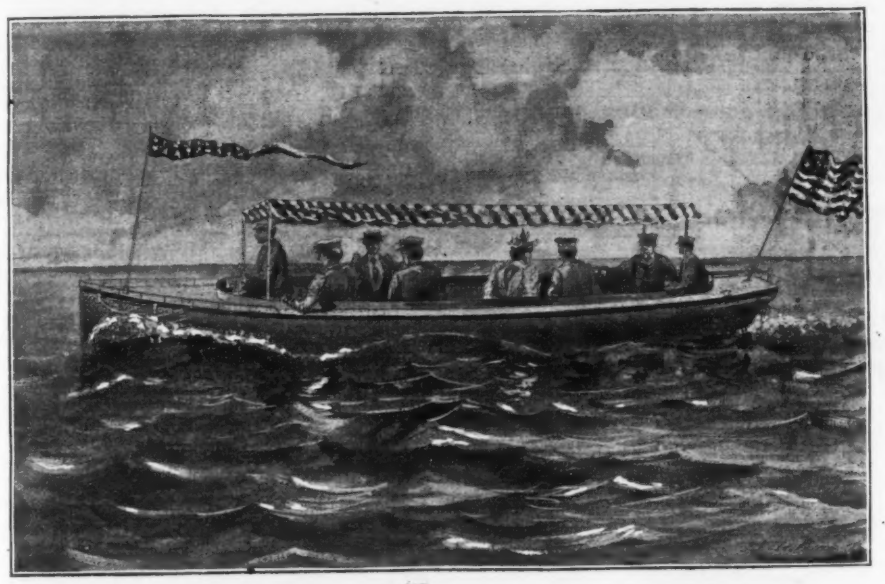
The working day is nominally of ten hours, as follows: From 6:30—12, and from 1—6. This gives a total of ten and one-half hours per day, but by putting in this extra half hour every day the men are enabled to obtain Saturday afternoons off, which, as may well be imagined, is a great boon. The present factory hours are from 6:45 to

* Abstract from an article in the Year Book of the Society of Engineers, University of Minnesota.

12 o'clock, and from 12:45 to 6 o'clock, the office men beginning at 7:45. Individual tools are supplied to the men and charged against their names. These must be returned upon leaving the factory or paid for. As regards a leave of absence, one can be obtained at almost any time. Plenty of special work of all kinds can be done, and many of the men put in quite a little time in the offices and draughting rooms. Every few days there comes in a request from some company for men, and the most suitable ones are selected. They often go as far away as South America.

Let us now watch a workman-student for a few minutes at his task. We shall find him on one end of Section C. Here the waterproof and other railway motors are assembled in pairs on stationary shafts, and geared together; they are then run on full load for ninety minutes. In this method one machine is run as a motor and drives the other as a generator. At the end of forty-five minutes their functions are reversed; the potential and current are noted, also the hot and cold resistances (the current for the latter being supplied by storage batteries) of the armature and field. Water rheostats are used for the load and railway rheostats for regulation. The machines are then taken down, cleaned and sent to the car shop, where they are painted and the finishing touches given; they are then sent to the shipping department. About twenty-five or thirty of these w. p. motors, 30 to 50 h. p., that is, per pair, are turned out daily.

When a student has completed his time on one subject, or it is thought desirable to shift him, he is given a card transferring him to another department. This card is generally given out Saturday morning, and the recipient reports to the new foreman the following Monday.



ELECTRIC LAUNCH FOR THE U. S. S. NEW YORK.

All except the office and draughting men must pass through a gate house on entering the factories in the morning and at noon, and pull a check, stamped with their number; this is deposited in a box. No man that pulls a check is allowed to work for that half day if more than an hour late.

Let us now enter the other end of Section C. We shall find a room where all transformers are tested, save the 30,000 watt. A number of boards are placed around the sides of the room, on each of which are four rows of terminals, the two upper being the positive and negative secondaries, the others being the primaries.

From the former, wires are run to banks of incandescent lamps overhead; the latter are connected with the dynamo, generally at 1,040, sometimes 2,080. One board will be for 600 watt transformers (12 lights) and each secondary will have that number of lamps on it, while another will be for 1,800 watts, and will necessarily require more lamps per transformer, and so on. When the transformers are placed on trucks before the boards, the covers are removed and each one is tested with a magnet for grounds; they are then wired up to the boards and the switch thrown in. The transformers have two secondary coils which if connected in multiple give 52 volts; if in series, 104. A run of five or six hours is made and then they are tested with a transformer, a variation with load of one volt being allowed; then the load is taken off by disconnecting the secondaries, and they are again tested; this time only a difference of half a volt being permitted. The machines are now flashed in connection with a standard. This shows whether the secondary coils are connected internally in a proper manner. The covers are then replaced, and the transformers sent to the shipper. When in use on 5,000-volt circuits the cases are filled with oil to increase insulation, between the primary and ground, secondary and ground, and primary and secondary.

The wiring consists essentially of putting up new wires about the shops, replacing fuses and helping to construct switchboards.

A great deal of the machinery is run by shop motors, as they are called, scattered all through the factories; some of them in almost inaccessible places, and a student is given a certain number of motors to look after. He arrives a few minutes before the whistle blows, starts them up, fills the oil cups, looks at the commutators, and sees that they are in good order generally. He must never allow them to stop if it can possibly be avoided. During the day he makes the rounds every half hour and takes readings on the voltmeter and ammeter; these he records and computes the horse power therefrom, the reports being handed in every evening.

A little practice in arc lamp assembling is given and proves very useful, as one learns to understand the lamps thoroughly.

Arc machine assembling and testing is one of the most interesting and instructive subjects to be found in the whole course, as it requires a great deal of skill and care properly to adjust all the complicated levers and parts of the controlling device; also to set the commutator properly on the shaft and to adjust the brushes correctly. There is a great deal to learn about the machine and there is certainly no better way than this.

The assembling and testing of incandescent machines, railway and charge generators and alternators consists mainly, as the title implies, in putting the various parts into shape and testing the machines.

In the arc lamp testing room the lamps are hung in long rows and the main things to learn are to adjust the carbons and to regulate the feed, both requiring a great deal of practice and care; for instance, if the lamp hisses we know that the arc is too short, and so change the regulation, or if it should flame the arc is too long. The lamps are tested, as a rule, for about six hours, three hours on each carbon. In adjusting the carbons, first one side is adjusted and then the other. The final test consists in pulling the carbons apart. If the flame does not go out it shows that there is something wrong with the lamp; as in case the carbons should give out or anything happen to the lamp, the current would not be short-circuited through it and hence the other lamps on the circuit would go out. Finally the lamps are polished and sent to the shipping room. Work on meters, winding of armatures and construction of transformers, consists mainly of standing by and watching other men labor. All that one is supposed to do is to pick pointers, occasionally lending a hand.

Besides the regular course, which is very valuable, there is a vast amount of special work which is of exceeding value to the student. The General Electric Company offers a similar course in its factories located at Schenectady.

At Middletown, Conn., the same company has provided a special course in marine work, the number of students admitted at any one time being limited to twenty.

Upon completion of the prescribed course at Lynn the student receives a certificate signed by the foreman and manager of the Expert Department. This certifies that the bearer "has completed the student course at Lynn factory in a satisfactory manner, and is deemed competent to install and operate the Thomson-Houston apparatus manufactured at the above-named factory."

Certificates are also given at Schenectady and Middletown.

Electric Launch for the U. S. S. New York.

The General Electric Launch Company will deliver in a few days a handsome electric launch, which we illustrate, to the United States Government for the new man-of-war New York for use as a captain's gig. As the cut shows, the launch is very neat in appearance, and passengers will appreciate the unobstructed view they will have from it as well as the absence of heat and smoke.

The launch is 30 feet long, 6 feet 10 inches beam and has a draught of 22 inches. The hull is built of seasoned white oak, planked with selected white cedar copper fastened, and with finishings of mahogany. The weight of the boat is 3,900 pounds, and she will seat 20 people. A speed of six or seven miles per hour can be maintained for five or six hours with one charging of the cells, but spurts at a greater rate of speed can be made for several miles.

There will be 64 storage cells of the latest improved form of the Consolidated Storage Battery Company, of the same type as those used in the World's Fair launches. The motor is of the General Electric Company's launch type, and is directly connected with a Tobin bronze propeller shaft. The cells are so placed beneath the seats and flooring as to permit the entire carrying capacity of the launch to be utilized with comfort to the passengers.

The cells are so connected electrically that by means of a controller they may be all thrown in series or in two or more parallel groups; by this means, with or without a resistance in circuit, the speed may be varied within considerable limits.

New Block Signal System.

Mr. J. B. Stewart, superintendent of telegraphs and signals of the West Shore Railroad, gave an exhibition recently of a new block signal system invented by himself and Mr. W. G. Wattson, division superintendent of the same road.

The system is applied to the Weehawken tunnel (4,200 feet long), in which incandescent lamps are placed at intervals of about 100 feet, and divided into two sections; the height of the lamps is such that they are on a line with the window of an engine cab.

The lamps are normally lighted, indicating safety and a clear track. When a train enters the tunnel at the east portal, all of the lights outside of the tunnel (which extend 500 feet) and those for 300 feet inside are automatically switched off, as well as the alternate lamps for 900 feet farther in the tunnel. The overlap lamps, which alternate with the lamps in the first section, are left lighted for the train to run on to a point 2,300 feet inside, where the lamps in the second, or middle, section are put out, thus producing a dark or shadow section of 1,100 feet immediately behind the train, which is maintained until the train passes out of the tunnel at the west end. At the same instant that the lamps in the second, or middle, section are put out, those in the first section of 1,200 feet are lighted, so that when the train has reached a point 2,300 feet in the tunnel the signal to proceed is displayed at the east end of the tunnel for a following train. When the train passes out of the tunnel at the west end, the lamps in the middle section are lighted. This is all done automatically by the train passing over an electrically connected track circuit, all the parts of which are very simple and can be understood and maintained by any ordinary lineman. The system is so arranged at Weehawken that the electric light circuits

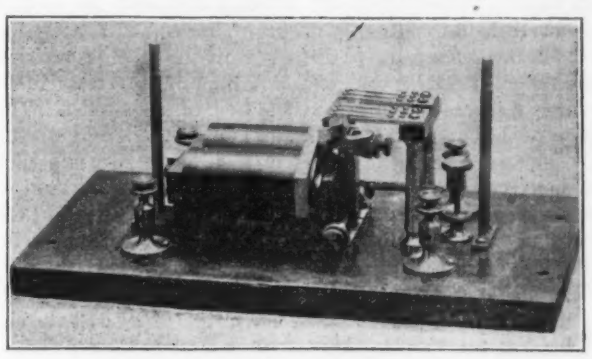


FIG. 1.—CIRCUIT SWITCH.

pass through the signal tower, from which the old semaphores are worked, and a lamp connected with each circuit in the tunnel is displayed, so that the operator can tell at a glance the whereabouts in the tunnel of a train. By opening a small switch he can put out the lamps in any section and stop any train; or he can put out all the lamps and stop all trains.

The mechanism for performing the various operations is, as stated before, simple and little liable to derangement. The two sections of track are insulated from each other and the two lines of rails on each section connected to the binding posts of a relay. The circuit of the relay is normally closed through one gravity cell, but the entrance of an engine on the section short-circuits out the relay, which then closes a local circuit which in turn through an ingenious switch shuts off the lamp current; the latter is again re-established by a reverse process when the train leaves the section.

Fig. 2 represents a plan of the tracks and circuits with, however, four circuits instead of two, as in the Weehawken tunnel. One cell in the track circuit is usually found sufficient instead of several, as shown. The lamps are shown in multiple series, but in practice would be placed in multiple, which would introduce, of course, no change in the principles or apparatus. The left hand instrument of each set is a relay, which is normally closed (as in the central set) when the section controlled by it is clear; when in this position it closes the circuit of the switch, which in turn closes the lamp circuit, thus showing the section to be clear. When a train enters a section the relay is short-circuited, the switch opened, and the lamps of the section just left go out. In case of the failure of either battery, the lamps would be put out, indicating danger. Fig. 1 shows the switch. A pivoted vertical piece carries the armature, as shown, and at the end has a crosspiece; the crosspiece is of two thicknesses, one being of an insulating material, (the left hand piece, showing light), and the other of brass. When the circuit of the switch magnets is closed by the relay, the contacts are on the brass portion, and thus keep the light circuit closed; when the switch magnet circuit opens, the armature is instantly pulled back and the contacts rest on the

insulated portion of the crosspiece, thus opening the light circuit.

While this system is applicable to any part of a railroad system, the automatic device, which has been successfully tested, is especially adapted for the quick movement of trains through tunnels under conditions of absolute safety. By its use the capacity of a tunnel 3,000 feet long or longer can be doubled or still further increased in proportion to its length; it also provides for the control of trains anywhere in it, and gives to the engineer, conductor and trainmen a constant visual signal for the movement of the train. It will not be necessary for the engineer to reduce speed when

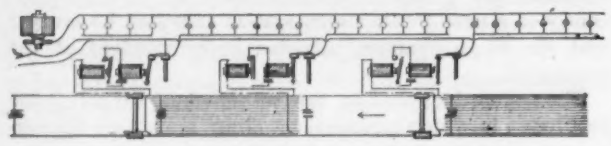


Fig. 2.—Plan of Tracks and Circuits.

approaching the end of a block section, expecting there to find the signal against him, as the dark section of 1,200 feet or more gives ample space to stop.

Under the present system of blocking, with one signal at the ends of the block sections, an engineer is liable to overlook or mistake the signal, especially when smoke or fog is thick and there is no way provided to stop the train after it passes the home signal, but, as stated before, with the new system the signal to stop can be given at any time by the operator cutting off the current from the lamps.

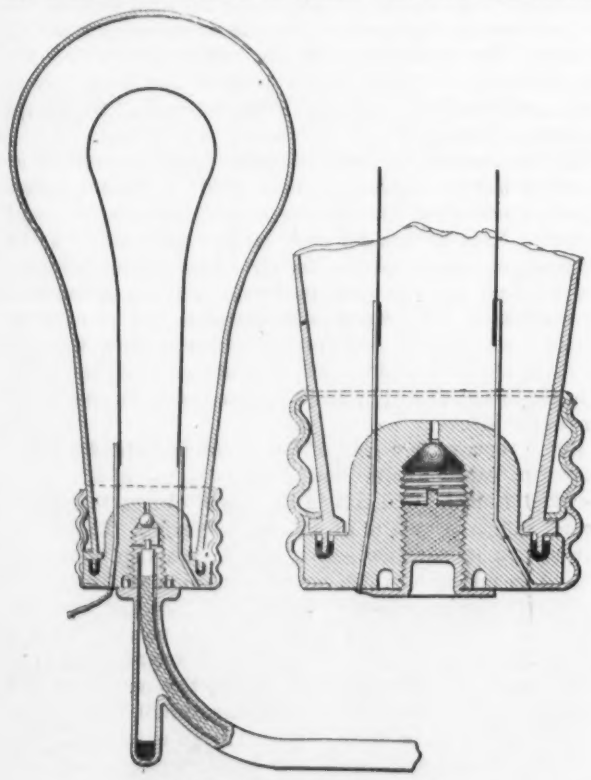
The exhibition given by Mr. Stewart was very successful, and the system seems to have a wide field of usefulness.

A New Incandescent Lamp.

A new incandescent lamp, which we illustrate, involving several interesting features, has recently been patented by Mr. A. E. Guy, of Washington, D. C.

The socket is provided with a groove, in which a little mercury is placed. The globe, which need not be blown, and may be cast, has at its base a thin projecting ring of glass, inside and outside of which thin rings of asbestos are slipped, thereby forming a packing for the mercury and its vapors. Then the globe is connected with the socket, and both held together by means of brass shells, the inside one being split open so as to permit the placing of such around the neck of the globe. A plug of any convenient material is screwed in the central hole of the socket. The plug pushes up a little paper ball and stops before closing the top aperture. The socket is then made fast to a tube connecting with a vacuum pump and containing a flexible cable terminated as a screwdriver. The air is then exhausted from the lamp, and if such is to be the case, replaced by a gas, as in some lamps now on the market.

When the lamp is ready to be closed, the cable is put into motion and the plug is pushed up, the paper ball closing the top aperture. The vacuum tube is then turned downward and a little quantity of mercury contained in a recess falls into the socket, passes through a groove in the plug and surrounds the paper ball. The lamp is withdrawn, the central hole half filled with plaster of paris, and a brass cap secured in place. The wire connections



A New Incandescent Lamp.

are established as shown in the enlarged sectional view of the socket of a completed lamp.

The socket can be cast of glass or porcelain and made of any shape, to suit any of the lamps now in use. The brass sleeves are stamped. If found more convenient for certain lamps the central hole can be dispensed with, the globe being then provided with screw threads inside and outside, as such threads are easily moulded.

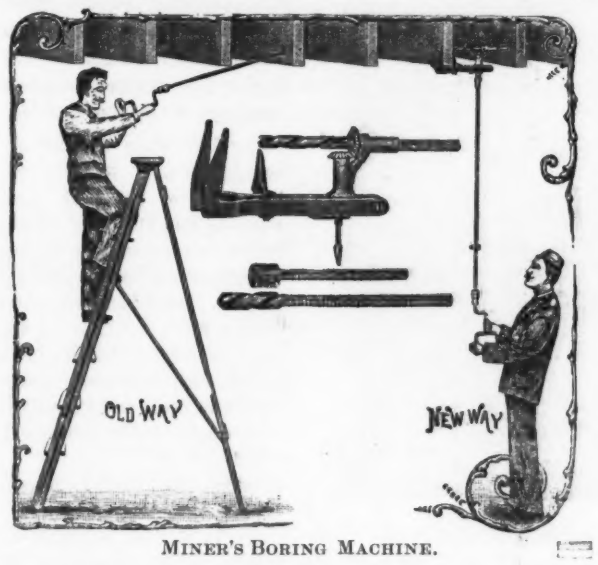
The renewal of the carbon filament is done by a very simple operation necessitating no skilled labor, and the lamp is thus given, at the cost of a few cents, a life which, barring accidents, may be considered as indefinite.

The globe of the lamp, as stated before, need not be blown; it comes out of the mould complete and ready for use. The blowpipe is no more required for making or sealing the lamp, and the delicate operations by which the "all glass" lamp is now made are entirely avoided.

The simplicity and the small cost at which it is claimed the lamp can be made are qualities most desirable in any article of manufacture; but to these qualities is added a still more important one in this lamp, viz., the easy renewal of the carbon filament without any alteration whatever to the different parts of the lamp.

Miner's Boring Machine.

In the accompanying illustration is shown a piece of apparatus placed on the market by the Detroit Electric Wiring and Repair Company, 82–84 Griswold street, Detroit, Mich., which is especially adapted for electric wiring contractors, and indorsed, it is claimed, by architects' underwriters. It is intended for the rapid boring of holes in joist, and it is stated that not only much exertion is saved, but that the work is done in one-third the time. Ladders are unnecessary. By boring holes at direct angles and at even distances from the bottom of the joist the wire can be put through easily and pulled from one side of the room to the other, and there is also a saving of wire since it is run in an absolutely straight line. As the holes are clean cut there is less danger of injury to the insulation. The single boring machine is simple and strong of construction and weighs less than four pounds. The double boring machine bores two holes at the same time, and is equally strong and simple in proportion to the single machine. Both are automatic in feed, and adjustable to fit and bore timbers to five



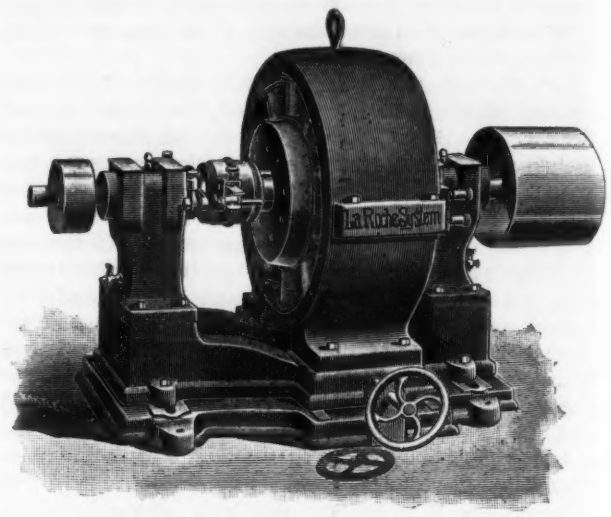
Miner's Boring Machine.

inches in thickness. Different sized bits or a tongue can be used with the extension shank placed between it and the stock; it can be adjusted for any height of ceiling. For several hours' work it is claimed that it will turn on an average one hole per minute.

The La Roche New Alternating Current Dynamo.

The accompanying cut represents one of the types of alternating current machines built by the La Roche Electric Works of Philadelphia, which was one of the first companies in this country to make a specialty of alternating current apparatus. To meet the demand for small alternators, this company now builds them from 25 to 16,000 or, more accurately speaking, 133 alternations per 16,000 or, more accurately speaking, 133 alternation per second. The machines from 25 up to 500 lights are arranged with 10 poles running at 1,600 revolutions giving the above frequency, while the large machines have more poles and run at a slow speed so as to give the same frequency. These alternators are from the design of Mr. F. A. La Roche and have all the modern improvements and all parts interchangeable and made to gauge. They have self-oiling bearings and automatic oil overflow. The brush-holders are of a new design, and are so made that any desired tension can be secured. The collector rings are made of specially ground copper, well insulated with mica. In the smaller machines the fields are made separable, so as to facilitate the repair work. The pole pieces are separately wound and slipped over the core.

The armature is built up of the best laminated, pure charcoal iron, well magnetically insulated. The core is well screwed to a polished steel shaft. The shaft is turned down where entering bearings to standard size. The armature coils are separately wound, and any intelligent person can replace any or all in a very few minutes, as this company has a new method of securing the coils to the core. It also has a new method of connecting and winding the armature, whereby the difference of po-



La Roche Alternating Current Dynamo.

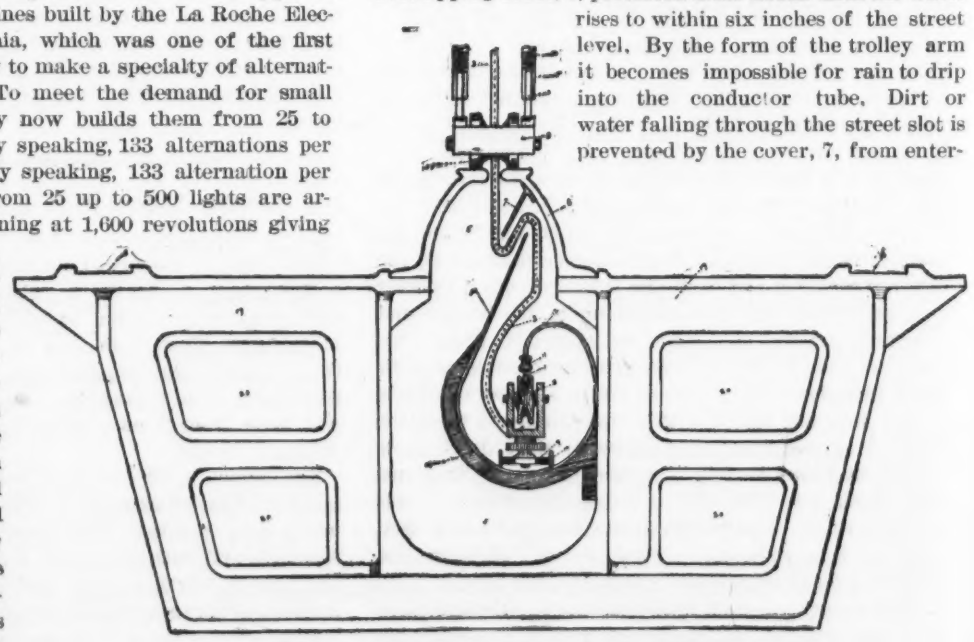
tential between coils never exceeds 200 volts, while in machines of other systems now in use, the difference of potential between coils is often from 500 to 1,000 volts. By the La Roche system it is almost an impossibility, it is claimed, to have a burn-out or short-circuit from lightning. The coils are insulated from the core of the armature by the best grade of mica. It will be noticed that the above cut is not of the self-exciting type; neither is the exciter attached in this illustration.

As a test of some of these machines, it was shown that there was a variation of only 2 3-10 volts between no load and full load, which is a sufficiently close regulation for any alternating machine.

All the machines have a cast iron sub-base well secured and mounted, so that no foundation is required, as the sub-base answers that purpose.

A New Conduit Railway System.

Our illustration shows a recently invented conduit system brought out by the Electrical Conduit Traction Equipment Company, 94 Wall street, New York City, which has many points of merit and overcomes many of the objections hitherto brought forward. Some electrical conduit systems have been practically inoperative on account of the arcing of the current from the electrical conductor to surrounding parts, caused by the insulation used not being adequate to prevent it; and also on account of the drip from the slot rail opening and consequent flooding of the conduit, while in many others the numerous mechanical parts often get out of order. In the accompanying illustration of the system is shown a cross-section with yoke, 17, as in cable road construction, which supports the conduit, 5, and slot-rails, 6. The chamber in which the conductor, 1, is placed, is, by the overlapping cover, 7, protected from floods until the water rises to within six inches of the street level. By the form of the trolley arm it becomes impossible for rain to drip into the conductor tube. Dirt or water falling through the street slot is prevented by the cover, 7, from entering the tube which contains the electrical conductor, etc., and is gathered at the bottom of the large chamber. Ample air insulation is given by the conductor being placed centrally in the trolley chamber. The lateral and perpendicular motions of the trolley arm are provided for by the guide carriage and the point of contact of the trolley wheel on the trolley may be at the top or bottom of it.



A NEW CONDUIT RAILWAY SYSTEM.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

[Inquiries from our patrons for information relative to stocks and bonds of the various electric light and power companies are solicited, and will be answered in this column.]

NEW YORK, June 5, 1893.

Speculative feeling during the past week has been more inclined to bearishness than in the preceding weeks of lower prices. True, the tendency toward a lower level of quotations has not been so pronounced, neither have fluctuations in values been of such a violent character as marked stock market transactions in the beginning of last month, but the prevailing sentiment has been of a sufficiently depressing nature to warrant the belief that not the worst in a good many instances has yet been seen. On the other hand, a decided rally from the present range of prices would not surprise those who are acquainted with the conditions surrounding the market. Every little trader has felt himself obliged to agree with the doleful statements emanating from higher sources and, while liquidation on a large scale is responsible in a great measure for the decline in prices, thousands of shares of stocks, particularly the "Industrials," have been sold short by the small fry, thereby materially helping along the slump. The short interest that now exists is immense—in fact, it is becoming unwieldy. What is more, the big bear leaders have of late been practically out of the market and the bear party is wholly unorganized. Some of the big bear operators are, however, now getting ready to start a new bear campaign. Before they do this they will have to shake out the large short interest, and, moreover, they will have to bring about a higher range of values in order to have a better basis to work upon.

The General Electric is an instance of how easily the present bear contingent can be scared into covering its short contracts. The bears for some weeks have seemingly done as they pleased with the stock. They sold it when they pleased and slaughtered its quotations as often as their fancy prompted. Insiders were apparently perfectly unconcerned as to what the stock was doing, being willing, it seemed, to let it take care of itself. Under such conditions the price went steadily down until on Monday last 64¼ was reached. Towards the middle of the week, however, different tactics were resorted to by the General Electric Company's insiders. Wednesday morning, the day after the holiday, the stock opened at 67; it then dropped to 66. Almost immediately big buying orders poured into the market. The bears, scared out of their wits, rushed to cover, and in a twinkling General Electric sold back at 75, a rise in one day of 9 points. Since then the stock has sold lower, but the episode gives an insight into the condition of the market. Apropos of the continued agitation regarding the sale of its treasury assets, the General Electric people officially assert that the securities so far sold have brought prices far above, and in some instances double, the figures at which they have been quoted in the company's own appraisement, as given in the company's recent annual report.

Edison (N. Y.) Illuminating Stock shows another indication as to the erratic condition of affairs; on Friday it broke 4 points on a sale of 100 shares. The weakness is attributable to the fact that the company has been unable to secure in this city some funds recently needed. The money was, however, it is reported, secured in Boston.

The Edison Electric Illuminating Company of Brooklyn is doing a very good business. The increase of current required every month ranges from 3,000 to 6,000 lamps. The company is now building an addition to one of its stations, and when completed the three stations of the company will have a combined capacity of 200,000 lamps. There is every prospect of a 6 per cent. dividend in sight with a capitalization of $2,500,000. The stock is now quoted at 103, and is held almost entirely as an investment.

The Westinghouse Electric and Manufacturing Company is said to have done the largest business in May in its history. Some of the Boston friends of the Westinghouse Company have been urging Mr. Westinghouse to sell $2,000,000 of debentures to pay off the floating debt and leave the company's earnings free for division among the stockholders, but Mr. Westinghouse declares he can pay off the debt this year from the company's earnings.

The National Electric Manufacturing Company Asks for a Receiver.—In the Circuit Court, on May 23, proceedings were taken by which the National Electric Manufacturing Company's plant, of Eau Claire, Wis., passed into the hands of a receiver. An action had been brought by Jas. T. Barber et al. against the National Electric Manufacturing Company, H. H. Hayden being the attorney for the plaintiff, the complaint in which sets forth that the company was embarrassed by very pressing claims on the part of creditors which it was unable to pay; that the large plant and valuable business of the company could best be preserved in their entirety for the benefit of all concerned by the appointment of a receiver, etc. Mr. Hayden requested the appointment of Ralph E. Rust as receiver, bond being offered in the sum of $50,000, with William A. Rust, John S. Owen, Jas. T. Barber and Fitch Gilbert as sureties. The same being properly filed, Judge Bailey made an order appointing Mr. Rust receiver. Although the company, by reason of the general financial stringency, has been considerably embarrassed, the conditions are such that under the receiver the business can and will be carried on without any interruption whatever. There will be no stoppage, and a reorganization will probably be effected within a very few days. The company's plant is worth $300,000, it is claimed; there is a large amount of valuable manufacturing products on hand, and there are also large outstanding orders. The assets foot up between $500,000 and $600,000; the liabilities are about $300,000. The placing of the plant and affairs of the company in the hands of a receiver is regarded as the very best possible solution of the difficulties which have been encountered.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	25	30
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	100		
" " " lsts		112	112½
*Edison Electric Ill., Brooklyn	100	98	103
" " " Boston	100	115	130
" " " Chicago	100	220	230
" " " Philadelphia	100	120	140
Edison Electric Light of Europe	..	2	6
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	12½	12¾
General Electric Company	100	70¾	71
" deb. 5's	..	84	84½
Interior Conduit and Ins. Co	100	40	50
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	25	30
" " pfd	50	..	47

* Ex. div.

AFFAIRS OF THE COMPANIES.

The Sioux City (Ia.) Electrical Supply Company has increased its capital from $25,000 to $100,000.

The Mexican Telephone Company has issued its annual report for 1892-1893, showing a total of net earnings for the year in Mexico of $42,405, an increase of $12,707 over the preceding year.

West End.—The gross earnings of the West End Street Railway for 29 days of May show an increase of over $64,000 as compared with the like period a year ago. Total gross earnings for the month should show a gain of over $68,000.

The Water, Light and Power Company, of Hot Springs, So. Dak., which was recently incorporated, has bought out the Hot Springs Electric Light Company. This company is capitalized at $100,000, and its officers are: F. T. Evans, president and treasurer; F. T. Evans, Jr., vice-president; H. D. Clark, secretary, and W. H. Train, manager and purchasing agent.

The Detroit Electrical Works will, it is reported, soon be in the control of new parties with plenty of capital who will pay the old stockholders in full, giving their notes for 12, 18 and 24 months, secured by first mortgage bonds. In the meantime the factory will continue work as before on the orders now on hand until the usual legal forms can be complied with, which will take from 30 to 60 days. The old stockholders held a meeting on June 2 and were unanimous in accepting the above offer, Mr. Hugh McMillan placing his stock with the others, although he held a mortgage of $185,000.

The General Electric Company and its allied interests in France and other European countries, as well as in other parts of the world, have been operating on a very large scale. A cash order for incandescent apparatus of 9,000 lamp capacity with a variety of other machinery has just been received from Manila. A strong company has been organized in Paris, with ample capital subscribed locally, to manufacture and exploit the system of the General Electric Company in France, Spain and other parts of Europe. Of the stock and profits of the new company a considerable percentage is given to the General Electric Company for licenses under its patents. A similar company has been organized to exploit its system in Germany and Belgium, at the head of which is Herr Ludwig Loewe, the famous arms manufacturer of Berlin. It has contracts for many large and profitable railway installations.

NEW INCORPORATIONS.

The Muncie Electric Railway Company, Muncie, Ind., capital stock $200,000, has been incorporated. A. W. Hatch, W. C. Nichols, Ed. McDevitt and J. C. Devor are the promoters.

The Towanda Traction Company, Towanda, Pa., capital stock $2,000, has been organized to construct and operate an electric railway. G. W. Kipp, E. F. Kizer and L. C. Salsbury are the incorporators.

The Tioga Point Electric Light and Power Company, Athens, Pa., capital stock $3,000, has been formed to furnish light heat and power. The organizers are G. A. Kinney, M. P. Murray and E. K. Harris.

The Electric Light and Power Company of Sayre, Pa., capital stock $3,000, has been incorporated to furnish light, heat and power. G. A. Kinney, M. P. Murray and F. K. Harris are the interested parties.

The High Shouls Company, Harden, N. C., capital stock $50,000, has been formed to generate electricity, etc. D. A. Tompkins, R. M. Miller, Jr., and Fred. Oliver, Charlotte, N. C., are the promoters.

The Peoria Street Railway Company, Peoria, Ill., capital stock $100,000, has been formed to build and operate an electric railway. C. J. Puffer, Valentine G. Hietter and L. M. Thurlow are the incorporators.

The Boulder Electric Power Company, Creighton, Neb., and Independence, Mont., has been formed for furnishing power. A. N. Howley, Big Timber, Mont.; L. P. Ash, C. W. Hamilton and E. A. Crum are the promoters.

The Pleasure Resort Railway Company, Denver, Colo., capital stock $100,000, has been incorporated to build an electric street railway. E. E. Sommers, L. F. Kimball, Wm. Thorn, E. C. Skiles and C. E. Skiles, of Denver, are interested.

The Electrical Supply and Construction Company, Kansas City, Kan., capital stock $10,000, formed. W. S. Welson, B. F. Moats, Kansas City, Mo.; W. H. Campbell, J. F. Frankey and H. G. Gouge, of Kansas City, Kan., are the incorporators.

The Enterprise Manufacturing Company, Hartford, Conn., capital stock $125,000, has been formed to develop and sell water and electric power, etc. A. L. Shipman and A. Brainard, of Hartford, Conn., and R. V. Briesen, New York, are the promoters.

The College Hill Electric Railway Company, Cincinnati, O., capital stock $10,000, has been organized to build and operate an electric railway. P. G. Thomson, Lowe Emerson, Adam Gray, N. L. Pierson and S. W. Ranop are the incorporators.

The Mount Pleasant & Hammondville Electric Street Railway Company, Mount Pleasant, Pa., capital stock $18,000, has been formed to construct and operate an electric railway. Monroe Morrison, U. B. Hubbs and F. H. Sheppard are the organizers.

Bar Harbor, Me.—The Bar Harbor Electric Light Co. has been organized at Portland, Me., for the purpose of supplying light, heat and electricity; the capital stock is $75,000. George F. West, of Portland, Me., is president, and Luther A. Leach is secretary.

The Hillsboro Water, Light and Power Company, Hillsboro, Tex., capital stock $50,000, has been formed to supply light and power by electricity, etc. D. M. Croshwait, Kyle; Walter Tips, Austin, and T. F. Voight, Dripping Springs, Tex., are interested.

The Bar Harbor Electric Light Company, Portland, Me., capital stock $75,000, has been formed to manufacture and deal in electricity for light, heat and power, and in gas. G. F. West, G. P. Westcott and F. E. Richards, Portland, Me., are the incorporators.

The Indiana Electric Power Company, Goshen, Ind., capital stock $300,000, has been incorporated to construct, maintain and operate electric street railways, etc. G. F. Coleman, C. D. Firestone, Columbus, O., and H. E. Kratz, Norristown, Pa., are the promoters.

The Lake View Water Company, Redlands, Cal., capital stock $1,000,000, has been formed to erect and maintain electric plants, etc. The promoters are R. J. Waters, E. G. Judson, W. A. Main, A. B. Sterling, Redlands, and J. G. Clark, New Haven, Conn.

The Tharin Electric Company, San Francisco, Cal., capital stock $100,000, has been formed to produce electricity for light and power. The incorporators are A. G. Wood, G. V. Daniels, H. M. Shaw, San Francisco; G. H. Bartlett, Tharin, and A. Cornwell, Oakland, Cal.

The Philadelphia & Fox Chase Passenger Railway Company, Philadelphia, Pa., capital stock $75,000, has been incorporated to construct and operate an electric street railway in Philadelphia. H. S. McCaffrey, T. E. Bannon and E. O. O'Neill are the promoters.

The American Electric Heating Corporation, Portland, Me., capital stock $5,000,000, has been formed to manufacture and deal in electric heating apparatus. E. Jewell, E. W. Pierce, A. Eastman, F. A. Cooke and H. E. Cooke, all of Boston, Mass., are the interested parties.

The Allegheny Valley Heat, Light and Power Company, New Kensington, Pa., capital stock $15,000, has been formed to generate electricity for the purposes indicated by its name. The promoters are M. L. Knight, J. T. Reeves, T. P. Simpson, J. P. Stone and C. R. Wylie.

The Frankford, Bridesburg & East Fairmount Park Railway Company, Philadelphia, Pa., capital stock $78,000, has been formed to construct and operate an electric railway in Philadelphia, Pa. Geo. W. Rich, Jas. F. Gossner and John W. Frazier are the incorporators.

The Woodstock Electric Company, Woodstock, Vt., capital stock $22,000, has been organized to manufacture and deal in electricity for light, heat and power purposes. F. W. Wilder, A. M. Mills, A. B. Wilder, F. R. Jewett and P. Royce, all of Woodstock, are the promoters.

The Cleveland Surgical and Electrical Instrument Company. Cleveland, O., capital stock, $25,000, has been formed to manufacture and deal in surgical and electrical instruments, etc. J. B. McQuigg, J. M. Monroe, A. G. Langell, G. B. Riley and John Colahan.

The Grand Island Rapid Transit Light and Power Company, Grand Island, Neb., capital stock $50,000, has been formed to construct and operate a street railway by electric or other power. A. S. Vest, E. G. Stalley, M. L. Stern, C. G. Ryan and G. R. Furr are the promoters.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-176 TIMES BUILDING, NEW YORK, June 5, 1893.

The Broadway Railroad Company, of Brooklyn, has asked permission to substitute the trolley for the horse and to largely extend its lines.

The electric wiremen's difficulties with the Electrical Contractors' Association still continue, and many of the members of the latter now employ only non-union men.

Inspector of Electricity.—Some disgruntled customers of the New York Edison Illuminating Company have started a movement to secure a State inspector of electricity.

Coney Island.—The Atlantic Avenue Railroad Company, of Brooklyn, has started to run the electric cars on its line without change from Fifteenth street and Hamilton Ferry to the Coney Island station at Thirty sixth street.

The Colwell Lead Company, 63 Centre street, New York City, on account of the destruction by fire of its uptown branch store, has opened a branch lead department in connection with the William McShane Company at 117 West Forty-second street, New York City.

Mr. Geo. J. Jackson, general agent for the Norwich Insulated Wire Company, sailed Saturday, May 27, on the Etruria, and will be absent some four or five weeks. Mr. Jackson goes in the interest of the company which he represents, and during his absence will visit England, France and Germany.

T. W. Ness, the well known telephone manufacturer of Montreal, has been spending considerable time in Boston and New York investigating the telephone situation in this country. During a call at the office of THE ELECTRICAL WORLD Mr. Ness informed us that his business was in a flourishing condition.

Mr. K. Iwadare, of the Osaka Electric Light Company, is on a visit to the United States to take in the World's Fair and note recent developments in electric lighting. The Osaka company is one of the largest in Japan, the plant serving over 10,000 incandescent lamps besides a large number of arcs and motors.

Mr. Gisbert Kapp has returned to New York from Chicago, and will sail for England on the 14th inst. Mr. Kapp expresses himself as highly pleased with the World's Fair, which largely exceeded his expectations, and particularly with the electrical exhibits, which he found in a much more advanced state than he had been led to expect.

Reporting Vessels at Sea through the Atlantic Cable.—Captain Trott, of the cable steamer Minia while at sea in latitude 47° 3)′ north longitude 32° 80′, west reported through the end of an Atlantic cable which he had on board for repairs the following steamers bound west May 23: Manhattan, a Red Star steamer; and the Paris of the American Line and the Mohawk, of the Atlantic Transport Company, on the 25th, in the same position. Captain Trott has reported steamers in mid-Atlantic on several previous occasions and was the first to introduce this novel method of making known the whereabouts of ocean steamships, which is always greatly appreciated by those immediately interested in them.

Messrs. A. L. Bagnall and L. D. Hilles, of the firm of Bagnall & Hilles, contractors and dealers in electrical supplies and electric lighting apparatus, Yokohama, Japan, are in the city, calling upon the trade, for the purpose of purchasing supplies, etc. These gentlemen are identified very prominently in the electrical business in Japan, are representatives of the Brush Electric Company, Short Electric Railway Company, the New York Insulated Wire Company, and other well known manufacturers. Their interests are very extensive in Japan, and they have no less than 42 sub-agents. Messrs. Bagnall and Hilles will remain in the United States for about thirty days, visiting different cities and will pass some time at the World's Fair. They have just shipped the entire electrical equipment for a plant which will be installed at Manila, the capital of the Philippine Islands. This is their first visit to this country for some two years or more, and their statements regarding the growth of the electrical business in their part of the world are most interesting, showing that Brush apparatus and Grimshaw white core wires are highly in favor.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., June 3, 1893.

The Pratt & Whitney Company, of Hartford, Conn., will increase the capacity of its works by the erection of a new building.

The Southington & Plantsville Tramway Company contemplates enlarging the capacity of its electric plant. Its works are located at Southington, Conn.

The Lowell, Lawrence & Haverhill Street Railway Company is adding to its plant 2,000-h. p. capacity of Green boilers, two General Electric 500-h. p. dynamos, and 650-h. p. Babcock & Wilcock boilers. The dynamo station will be 143 feet high. The work is being done under the superintendency of the Massachusetts Electrical Engineering Company.

A very happy event took place at First Church, Boston, Mass., last Thursday, when Mr. Edwin Sibly Webster, of the Massachusetts Electrical Engineering Company, and Miss De Peyster Hovey, of Boston, Mass., were joined in the holy bonds of matrimony. Mr. Webster's very many friends join in wishing him and his bride every happiness and prosperity.

The Lynn & Boston Street Railway Company's new power house is a model structure. The boilers have a capacity of 2,500 h. p. The engine room will contain five 100-h. p. engines, and each engine will operate five 100-h. p. T.-H. dynamos. It is expected that this equipment will give sufficient power to run 100 cars at from six to eight miles in any direction from the station.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 MONADNOCK BUILDING, CHICAGO, June 3, 1893.

Mr. J. G. Helms, of the Milwaukee, Wis., Electric Railway Company, brother-in-law of Mr. C. E. L. Brown, accompanied that gentleman about the Fair.

C. M. Howell and C. J. Loughren, of Ironwood, Mich., prominently identified with the Illinois Electric Lamp Company, have been in Chicago for several days during the past week.

The Mather Electric Company and the "Novak" lamp, Claflin & Kimball (Inc.), general selling agents, have removed to 1,001-2 Chamber of Commerce, La Salle and Washington streets, Chicago, Ill.

C. W. Register, formerly connected with the Accumulator Company as an expert, has been in Chicago for some days, but has recently left for Pittsburgh, where he has accepted a position with the Westinghouse company.

Mr. C. E. L. Brown, whose name is so intimately associated with long distance power transmission by electricity, particularly the Frankfort-Lauffen experiment, found many things to admire at the Fair during his visit last week.

Mr. Chas. A. Schieren, whose name is so well known in electrical circles in connection with the manufacture of belts, made a flying visit to the Fair to look after his two handsome exhibits. He will "see" the Exposition later.

C. A. Daigh, formerly general manager of the National Electric Company, has been appointed general sales agent of the Siemens-Halske Electric Company of America. His headquarters will be with the company in the Monadnock Building.

Mr. Arthur C. Bergthiel, of the engineering firm of Bergthiel & Young, London, was at the World's Fair during the week. Mr. Bergthiel is looking up American electrical interests, and studying them carefully with a view to establishing a London agency for a first class line of American appliances.

J. Holt Gates, formerly with the Siemens Halske Electric Company, has accepted the position of general Western agent of the Waddell-Entz company. His territory covers Michigan, Ohio, Kentucky and everything west and northwest of these States to Omaha. Mr. Gates enjoys a wide acquaintance and popularity in the West, and expects to do a large business for his firm. His temporary office will be 1,122 Monadnock Block. His permanent office will be 1,139-40 same building.

Mr. Hermann S. Hering, of the Johns Hopkins University, Baltimore, made the Chicago office of the ELECTRICAL WORLD a pleasant call one day last week. Mr. Hering made a flying visit to the World's Fair, and will return in a short time to make a complete study of the great Exposition. He was on his way back from Purdue University, where he has been invited to take the directorship of the School of Electrical Engineering. He has not yet come to a decision in the matter.

The New Sunbeam Incandescent Lamp, which is being manufactured by the Star Electric Lamp Company, of Chicago, is proving much superior to the old vacuum lamps. The gas uniting with the carbon when incandescent prevents, it is claimed, the drop of candle power which was unavoidable in the old style of lamp and maintains the lamp at full initial candle power throughout its life. Orders are coming in in increasing quantities, showing that the electrical fraternity appreciate the successful efforts of the Star Electric Lamp Company to supply an entirely new incandescent lamp.

The Electric Appliance Company is showing a very attractive line of Meston alternating current motors for special work at its World's Fair exhibit, space U 16. The Emerson Company, manufacturer of the well known Meston motors, and for whom the Electric Appliance Company is general Western agent, has made some new applications of its motors this season and now has its alternating motor applied to a dental outfit and also as a sewing machine motor, both of them being exceedingly practical combinations. Another specialty of this season is its revolving motor, which is a very ingenious piece of mechanism and a motor which promises to be very popular for ventilating purposes.

A Correction.—In our issue of May 27th there appeared under the heading of "Western Notes" an announcement of the organization of the McDonald & Hood Electric Company, and the further statement that this corporation would act as the general agents for the American Battery Company. The latter statement is premature, no arrangements between the two companies having yet been concluded. This company has leased a building at one time occupied by the Diamond Match Company, at 353 to 361 West Twentieth street, Chicago, and the installation of a very fine manufacturing plant is now well under way. A new office has also been taken in the Security Building, 188 Madison street, Room 709, and in a short time, it is expected, the company will be prepared to fill the large number of orders that have already been booked for the new American storage cell, Planté type. The new officers of the company are: President, Jonathan Abel; vice-president, Geo. J. Burroughs; secretary, Harold Sturges; treasurer, Wilson Ames.

Electricity at the World's Fair.—In order to give those who are visiting the World's Fair an opportunity to learn something of the nature of the exhibits, and to show them what it would be worth their while to look up, a series of lectures has been arranged which will be given in Room 58 of the Chicago Athenæum, 26 East Van Buren street, every Monday and Wednesday evening between now and Sept. 1. From 7 to 8 o'clock a lecture on the scientific and experimental exhibits will be presented, and from 8 to 9 of the same evening lectures on the dynamic and commercial applications of electricity as illustrated in the exhibits will be given. These lectures will constitute a course of four, covering the entire electrical exhibit, but each will be complete in itself so far as possible. The lectures on the experimental subjects will be given by Prof. C. B. Thwing, widely known as the University Extension lecturer, and those on applied electricity by B. B. James, A. M., of Evanston. In addition to this, groups of from five to ten persons will be formed by Mr. James each Tuesday and Thursday morning at 26 East Van Buren street, and in the afternoons of the same days at the Fair Grounds by Prof. Thwing, and will be guided by these gentlemen through the Electricity Building, the principal displays being explained and points of interest brought out. Information in regard to this arrangemnt may be obtained by addressing Mr. E. I. Galvin, Chicago Athenæum, 26 East Van Buren street, Chicago, Ill.

OREGON CITY, Ore., May 29, 1893.

Garfield, Ore., recently voted to issue bonds in the sum of $20,000 for the purpose of establishing city electric lighting and water systems.

The East Side Railway Company has placed on its Portland-Oregon City line the first of its new Brill cars, 28 feet in length, with a capacity of 52 passengers. Upon a trial trip the car developed a speed of 22 miles an hour.

The Salem (Ore.) Motor Railway Company has completed an extension, three-fourths of a mile in length, of its electric line, and it is now ready for operation.

Grass Valley, Ore., is to be connected with the town of Moro by a telephone line ten miles in length, the route having been recently surveyed.

The Portland & Vancouver Railway Company's main line, which is being changed into an electric line, will follow Union avenue to East Washington, thence on East Washington to Water street.

The Salem Consolidated Street Railway Company, of Salem, Ore., has given a mortgage upon its property in that city to the Northwest Loan and Trust Company, of Portland, Ore. The mortgage, which is for $100,000, is to run six months from May 11, and bears eight per cent. interest.

The Oregon City Transportation Company has arranged with the City and Suburban Railway Company, of Portland, Ore., to transfer any passengers from the former company's boats to any point upon the electric railway company's lines without additional charge.

The East Side Railway Company, of Portland, Ore., has laid a new track on East Eleventh street, from Hawthorne avenue south, to connect with its Oregon City line at Stephens street. All cars on the Oregon City line will run via the new route. This company has in contemplation a possible extension of its Mt. Tabor electric line to Mt. Hood, a distance of forty miles.

News of the Week.

THE ELECTRIC LIGHT.

Rochelle, Ill., is to have electric lights.

Milford, Ill., is to have an electric light plant.

Kyle, Hays County, Tex., is to be lighted with electricity.

Ramapo and Hillburn, N. Y., are to have the electric light.

Whitehall, Ill., is making an effort to secure an electric light plant.

Lecompte, La.—Eugene V. Weems is in the market for an electric plant.

Madison, Me., has decided to raise $15,000 to pay for an electric light plant.

St. Genevieve, Mo.—Citizens have raised $18,000 for an electric light plant.

Lambertsville, N. J., is rapidly pushing the work on her electric light system.

Sheffield, Ill., is considering the propriety of putting in an electric light plant.

Ottumwa, Ia.—It is reported that a new electric light company will be organized.

Walden, N. Y., is having an electric plant put in by Wallkill Electric Light Company.

Elberton, Ga., contemplates erecting an electric light plant and water works system.

Chatfield, Minn.—The citizens are discussing the question of putting in an electric plant.

Quincy, Fla.—W. H. Ellis is interested in a contemplated electric light plant at Quincy.

Truckee, Cal.—The citizens are agitating the question of putting in an electric light plant.

Paw Paw, Mich., is to vote on the proposed issue of $15,000 in bonds for an electric lighting plant.

Akron, N. Y.—The residents of Akron are contemplating the organizing of an electric lighting plant.

Dowagiac, Mich., is to vote on a proposition to buy the electric plant now owned by private parties.

Woodstock, Vt., will soon have electric lights, $20,000 of the necessary $22,000 having been subscribed.

Higginsville, Mo.—The proposition to bond the city for water and electric light was overwhelmingly carried.

Port Washington, Wis., has granted a franchise for an electric light and power plant to F. A. Dennett, of that place.

Kendrick, Wash.—The Council has adopted a resolution to issue $7,500 in bonds for the establishment of an electric light plant.

The electric light plant at Traer, Ia., will be completed on a larger scale than was contemplated. Additional machinery will be purchased.

Westwood, O.—An election is to be held June 12 to vote on the question of issuing $25,000 in bonds for the erection of an electric light plant.

Conshohocken, Pa.—The Street Lighting Committee will advertise for bids for the lighting of the borough for three and five years from January 1, 1894.

New Hampton, Ia.—The Council has granted a franchise to the New Hampton Electric Light and Power Company. Work will commence as soon as possible.

Detroit, Mich., has finally decided to erect a municipal electric lighting plant, and bonds to the value of $600,000 have been authorized to pay for the same.

Newburgh, O., Insane Asylum, W. S. Hough, President, is advertising for proposals for an electric lighting plant for 1,000 incandescents, bids to be opened June 21.

The Woonsocket (R. I.) Electric Machine and Power Company has been authorized to erect poles and to furnish electric light and power in Bellingham and Franklin.

Eau Claire, Wis.—The Council granted a franchise to the Eau Claire Telephone and Lighting Company to light the city for five years at $75 per arc lamp, and $7 per incandescent.

Urbana, Ill.—Sealed proposals will be received by C. B. Holmes, City Clerk, to noon June 15, for furnishing electric light to Urbana for a term of seven years, to include everything necessary.

Atlantic City, N. J.—The City Council has rejected all bids for street lighting, it being claimed that there is a combine between the two electric companies here, and the streets are in darkness.

Cleveland, O.—An appropriation of $12,000 has been made to equip the insane asylum with an electric plant with a capacity of 1,000 lights, and the board will at once make use of the appropriation.

Cambridge, Mass.—The special committee of the Cambridge city government appointed to consider the matter of a municipal electric lighting plant is now holding meetings and considering estimates.

Houston, Tex., Council has passed a resolution that the city own its water-works and electric light plant, and an election will soon be called to vote on the matter of a bond issue of $350,000 for that purpose.

Middletown, Pa.—An ordinance has been passed providing for a special election on June 27 to vote on a proposed bond issue of $28,000 to pay for an electric lighting plant. John Atkinson is president and John F. Fritz is clerk of the Council.

Kalamazoo, Mich.—The asylum trustees at a recent meeting authorized Superintendent Edwards to procure detailed specifications and bids for the electric lighting plant, boilers, water tower, etc., in accordance with the recent appropriation by the legislature.

Napoleon, O.—Sealed proposals will be received to June 20 for all labor and material required for the construction of an electric lighting plant, to include one high-speed engine, 150 h. p.; one arc light dynamo, one incandescent-light dynamo, wire, poles and complete outfit.

Sandusky, O.—Bids will be received to June 20 at noon, at the Soldiers' Home, for the furnishing complete of an electric plant on the grounds of the Home, sufficient to supply 1,500 incandescent lights and 20 arc lights, steam to be taken from the boiler now in use. The buildings are now wired.

Worcester, Mass.—Superintendent of Street Lighting H. A. Knight states that the contract for street lighting for the coming year with the Worcester Electric Light Company will be discussed by City Council about the middle of June, and that the Council will then also consider the matter of a municipal plant.

The Norwich Light and Power Company, of Ballston, N. Y., has been formed here to operate the gas and electric plant at Norwich, in Chenango County, N. Y., formerly owned by the Norwich Electric Illuminating Company. Edward F. Murray, of Troy; Louis W. Emerson, of Warrensburg, and Herbert C. Westcot, of Ballston, are the interested parties.

Huntington, L. I., N. Y.—The Huntington Electric Light, Heat and Power Company has been granted a franchise for supplying light in districts Nos. 1, 2 and 3. It is stated that a franchise was also granted to the Standard Gas Company, which also proposes to light the village by electricity, and as there is not room for two companies it is now a question of which will soonest get its plant into operation.

Detroit, Mich.—The Council special committee on streets and ordinances has decided to recommend that the firm of Parke Davis & Co. be given a general electric lighting franchise for 12 years, covering the entire city. The committee proposes to charge the firm $5 a mile for every mile of wire each year, and $1 a year for every pole. The firm is prohibited from selling to other companies, or combining with other companies on rates of service.

THE ELECTRIC RAILWAY.

Bath, Me., has commenced work on an electric railway.

Waterville, N. Y., is discussing an electric railway to Deansville.

Nantasket Beach, Mass., street cars are to be run by electricity this summer.

Marion and Mt. Vernon, O., are named as the termini of a 40-mile electric railway.

Iowa City has appropriated $15,000 toward an electric railway, to be commenced at once

Troy, N. Y.—The Troy City Railroad Company has petitioned for leave to change its motive power to electricity.

Bayonne, N. J.—The Bayonne City Rapid Transit Company has petitioned for an electric street railway franchise.

Hannibal and Philadelphia, Mo., are having a route surveyed for an electric railway to connect the two places.

Youngstown, O., is discussing other electric lines to connect that city with Hubbard, Sharon, Warren and Brookfield.

The Rapid Transit Railway Company, of Salt Lake, Utah, it is said, will extend its lines to North Salt Lake.

Waterbury, Conn., proposes to replace horses with electric power on its street railways, and to largely extend the lines.

Tewksbury, Mass., is to vote on a proposition to allow the Lowell & Submarine electric road to lay its tracks in the town.

Bar Mills and Bonny Eagle, Me., are discussing an electric railway, the power to be derived from a 3,000 h. p. waterfall.

Thomastown, Me.—It has been decided that the Rocland, Thomaston & Camden Railway is to be extended to Thomaston at once.

Rahway, N. J.—Ground has been broken for the Rahway Electric Railway, and Superintendent Jacques has 50 men at work.

The Lehigh Valley (Pa.) Traction Company has commenced work on an electric railway from Allentown to Gauff's hotel.

Jersey City, N. J.—The Jersey City & Bergen Railroad, at a recent meeting, decided to equip its line with electricity as soon as possible.

Elmira, N. Y.—The West Side Railroad Company, of Elmira, N. Y., has been granted permission to build lines and operate on certain streets.

Potsdam, N. Y.—A company has been organized to build a road from here to Colton. Foster L. Backus is one of the trustees of the company.

Lowell and Lawrence, Mass., capitalists are interested in a proposed road between these places along the south branch of the Merrimac River.

Newburgh, N. Y.—Russell Headley and Superintendent Loughran are getting right of way for the electric road from Newburgh to Waldon.

Toledo and Maumee, O., are, it is said, to be connected by an electric railway on a new and improved plan by Mr. B. P. Foster, of Findlay, O.

Amsterdam, N. Y.—The Common Council has granted permission to the electric road company here to extend from West Main street to the city line.

The Mount Pleasant & Hammondsville Electric Street Railway Company, of Mount Pleasant, Pa., capital stock $18,000, has been granted a charter.

Newberry, Pa.—A franchise has been granted to the Newberry Street Railway Company, and it will shortly apply to the Council for right to lay tracks.

Covington, Ky.—R. E. Talbutt, of Knoxville, Tenn., and Frank P. Helm have organized a company to build an electric air line from that city to Erlanger.

Cortland, N. Y., has granted a franchise to the Peekskill Surface Railway Company to build and operate a road to Lake Mohegan, Verplanck Point and Van Cortlandtville Cemetery.

The Hampden (Me.) & Winterport Electric Railway Company has been recently organized to build a line from Hampden through Frankfort, Winterport and Prospect to Stockton-Springs. The work is to begin at once.

Bucyrus, O., is the converging point of several proposed lines of electric railways. One line is to go to Galion, 12 miles distant. Another is projected to New Washington, through Sulphur Springs, 18 miles long.

Peekskill, N. Y., has granted a franchise for an electric railway to Lake Mohegan, Verplanck's Point and to Van Cortlandt ville. The Peekskill Electric Surface Railway Company will soon begin work on its road.

New York, N. Y.—Myles Tierney, of 271 West Seventy-third street, has the contract for the proposed Palisades Railway, which is to be built as far as Fort Lee and later extended to Nyack. Work has already been begun.

Upper Sandusky, O., is mentioned as the starting point of a 100-mile long electric system, to pass through six county seats and smaller towns, and act as a feeder in connection with a boat line to Northern Ohio lake resorts.

Elizabeth, N. J.—Silas D. Drake, a prominent local real estate man, and others will soon apply for a charter for the Ursion Park & Springfield Electric Railway to run up Morris avenue to Springfield, and possibly to Summit.

The Pittsburgh, Greensburg & Latrobe Electric Railway Company, Pa., has been incorporated with a capital stock of $1,000,000 to build an electric road between the cities named. Leonard Keck, of Greensburg, is interested.

Pueblo, Colo.—An ordinance granting right of way to the Union Street Railway Company has passed first reading. If granted the franchise the company will be required to have two miles of road in operation before one year from date.

Cohoes, N. Y.—C. P. Craig, E. H. Foster, Herman Kahn, H. C. Fruhting, Paul H. Andres and Henry L. Shaver are said to have each taken $1,000 or more of stock in the proposed street railway. A meeting for the official organization will soon be called.

Trenton, N. J., is to have an extensive belt line electric railroad, which will circle the whole town and suburbs. It will take in the Interstate Fair Battle Monument, Cadwallader Park, River View Cemetery, Broad Street Park and Greenwood Cemetery.

Syracuse, N. Y.—E. V. Emmons, who has charge of the proposed electric road to Manlius, is now in Long Branch, but he will return soon. Stockholders have decided to wait until the entire $250,000 capital has been subscribed before applying for a charter.

Directors of the Kentucky and Indiana Bridge Company, of New Albany, Ind., have called a meeting to provide for the issue and sale of $70,000 worth of the bonds of the New Albany Street Railway Company, the proceeds to be used to equip the line with electric power.

Wausau, Wis.—Messrs. Ross, Alexander, Jones & Deenfield, who have secured the franchise to build an electric street railway in Wausau, have asked for an extension for a year from the City Council on account of being unable just at present to obtain the necessary funds to carry on the work.

Doylestown, Pa.—H. S. Cavanaugh, attorney for the company which was to build an electric line from here to Perkasie, states that they will not build the road unless the turnpike companies give free right of way. This the companies have declined to do, and it is likely that the scheme will be abandoned.

Jersey City, N. J., has granted trolley franchises to the Jersey City, Hoboken & Rutherford and the North Hudson County railways. It is also considering the matter of granting a franchise for an elevated road to the Jersey City Rapid Transit Company, to extend from the Communipaw Ferry to Jersey City Heights.

Rochester, N. Y.—At a recent meeting the directors of the Grand View Beach Railway decided to begin at once the work of rebuilding that portion of the plant recently destroyed by fire. A committee has been appointed to purchase new power machinery, and Michael Doyle and Superintendent Gillett to purchase cars and equipment.

The Pennsylvania Traction Company's surveyors have commenced work upon the electric line from Middletown to Philadelphia. They will also build lines from Parkesburg to Oxford, from Downingtown to Guthrieville and from West Chester to Philadelphia. B. J. McGrann, of Lancaster, has been awarded the contracts for the roadbed of all the lines, and the Westinghouse company will furnish overhead work. The company is backed by a capital of $30,000,000.

A Great Network.—The application of the Consolidated Traction Company for use of 26 miles of streets in Newark is believed to be part of a plan arranged by that company, which has its head in New York City, and a Philadelphia syndicate to complete a system of lines connecting Jersey City with Philadelphia. It has been pointed out that by degrees franchises have been obtained connecting Jersey City with Newark, thence by easy stages to Paterson, Elizabeth, and even to Trenton. The Philadelphia syndicate is reaching out toward Trenton, where the two roads are expected to combine. It is said that not less than $80,000,000 capital is behind the enterprise. From the principal line thus established spurs are contemplated reaching through every suburban village and town, making in fact, a huge gridiron of trolley lines through the State. It has been computed that the railroad privileges thus sought are worth fully $100,000,000.

LEGAL NOTES.

Injuries to Passenger on Street Railways.—It is not negligence by itself for a passenger in a street railway car, operated by electricity by the trolley system, to rest her arm upon the sill of an open window.—(Schneider v. New Orleans & C. R. Co., Circuit Court D., La., 54 N. Fed. Rep., 466.)

Action on Policy for Fire Insurance.—In an action upon a policy insuring building, machinery, dynamos and other electrical fixtures of an electric company, it appeared that the fire produced a short circuit in the wires connecting with machinery in a part of the building remote from the fire, and that such short circuit caused such a strain on the machinery as to break it down. The fire was the direct cause of the damage to the machinery.—(Lynn Gas & El. Co. v. Meriden Fire Ins. Co., Supreme Court of Mass., 31 N. E. Rep., 690.)

The Newark (N. J.), "Journal" states that a supplemental bill of complaint has been filed by the Accumulator Company of that city in its case against the Consolidated Electric Storage Company in the United States Circuit Court at Trenton. The original bill of complaint was filed on Jan. 7 last. The defendants are charged with infringing on certain letters patent granted to the Société Anonyme la Force et la Lumière, as assignee of Camille A. Faure, of Paris, France, and called the "Faure patent," for the manufacture, sale and use of polarization or secondary electric batteries. The infringement on the patent by the defendants consisted of their having the active coating applied in the form of a paint, paste or cement made of diluted sulphuric acid. The complainants obtained a preliminary injunction against the defendants in January last. They requested the latter to return the profits and gains made by infringing, but have not been recompensed. They now ask that the defendants be made to appear and answer to the bill of complaint. They also ask for a provisional or preliminary injunction.

Tesla Patents.—Two suits have been entered by the Westinghouse Electric and Mfg. Company against the Thomson-Houston Electric Company, a corporation of Connecticut and a member of the General Electric Company, for infringement of a number of patents granted to Nikola Tesla, and to restrain the operation of a plant near Hartford, Conn., involving the multiphase distribution of electricity covered by Mr. Tesla's patents, which are now owned by the Westinghouse company. It is claimed for the Tesla patents that they broadly cover all systems for the distribution of multiphase currents of electricity for power purposes, and the fact that the Thomson-Houston and General Electric companies are, in their operations, making copies of the Westinghouse company's apparatus, together with the fact that these patents have heretofore been fully respected and acquiesced in by all parties, strengthens the position of the Westinghouse company. Efforts will be made by the Westinghouse company to have these suits brought to a final hearing during the present year. A successful termination of these suits will mean, it is claimed, that the only practical method of transmitting power over long distances by means of multiphase alternating currents of electricity will be entirely controlled by the Westinghouse company, a branch of the electrical business that will in the near future probably require more electrical apparatus than any other.

MISCELLANEOUS NOTES.

Baltimore, Md.—The Fire Commissioners will soon advertise for materials for their system of underground wires and also for proposals to construct the necessary conduits for the system.

Canal Trolley Boats.—The New York State Superintendent of Canals has already received five or six applications for permission to make an experimental trial of systems for the electric propulsion of canal boats.

Mr. Ervin S. Ferry, now Fellow in Physics at Cornell University, is to be Fellow in Physics and Electrical Engineering at the Johns Hopkins University, where he will engage in advanced work under Prof. Rowland and Dr. Duncan.

Mr. Lucius T. Gibbs recently resigned his position as electrical engineer of the Milwaukee Street Railway Company, to engage in a general consulting business in both mechanical and electrical lines, and has opened an office at 1,103 Pabst Building, Milwaukee, Wis.

Mr. Park Benjamin has sent us the following communication: "I have just learned that my name still remains of record as principal attorney in a very old application for patent of Daniel Drawbaugh, which is involved in the proceedings in the Patent Office taken by Messrs. Church & Church, against ex-Commissioner Simonds and Messrs. Foster & Freeman. My professional employment by the Drawbaugh interest terminated years ago; and now that my attention has been called to the survival of this merely technical and quite forgotten relation, a prompt withdrawal, duly filed, has ended that also."

Trade and Industrial Notes.

Ahern & Soper, car contractors, Ottawa, Can., are turning out 20 cars for the Montreal Street Railway Company, which will be equipped with Westinghouse motors and furnished ready for operation on the tracks.

The Electrical Piano and Motor Company, of Newark, N. J., manufacturer of the Feldkamp electric ceiling fans and motors, reports unusual activity in its line, large and numerous orders being daily received.

Messrs. Wm. C. Callmann & Co., 136 Liberty street, report a large demand for the Feldkamp ceiling fans, fan motors and dynamos for both direct and alternating currents. This company is handling the High switch, with considerable success.

The Worcester Consolidated Street Railway Company, of Worcester, Mass., has placed the contract for its new car house with the Berlin Iron Bridge Company, of East Berlin, Conn. The new building will be 95 feet in width and 290 feet in length, entirely of brick and iron.

Mr. U. T. Fackenthall, vice-president and general manager of the Electrical and Mechanical Engineering and Trading Company, 41 Broad street, New York, says that, notwithstanding the season, his company is exceedingly busy, and is exerting its utmost ability to execute its orders.

The E. G. Bernard Co., of 43 Fourth street, Troy, N. Y., has issued a handsome 64-page, 9½ × 6 in., catalogue of general electrical supplies, principally house goods. The catalogue is uniform with the very complete and practical catalogue of electric light supplies recently issued by this enterprising house.

The Detroit Electric Wiring and Repair Company, 82-84 Griswold street, Detroit, Mich., has given notice that Mr. Joseph Abrahamson, formerly connected with it, has disposed of his interest in the company and severed his connection with it. Mr. F. J. Miner and Mr. F. B. Sidler now constitute the firm.

The Oerlikon Company, of Zurich, Switzerland, has recently sent us its latest catalogue on alternating current motors. It includes a number of cuts of the different sizes of machines, and tables giving various data concerning them including more than is usually given in such tables. As is well known this company has been one of the most successful in the commercial introduction of alternate current motors.

Curtis Steam Traps.—The d'Este & Seeley Company, Boston, Mass., makers of the Curtis steam turbine, have just received an order from the McGahan Sugar Refinery, at Philadelphia, for 40 No. 2 traps, each trap to be supplied with a glass water gauge and an automatic air valve. In order to secure the highest economy of operation such minor appliances as these should be of the highest quality, which is the claim made for the apparatus of this company.

The Commercial Electric Company, of Indianapolis, Ind., since its organization some eight years ago has made rapid advances, and is now furnishing dynamos for direct connection with engines at a speed of from 300 to 400 revolutions to meet the demand which has arisen for such combinations in the lighting of ships and office buildings where floor space is an important item. Mr. Geo. L. Colgate, of the C. & C. Electric Motor Company, assumed charge of the New York office on June 1, and from his past record will undoubtedly meet with excellent success.

The Stirling Company, through its sales agent, Mr. Fred A. Scheffler, 71 Cortlandt street, New York City, requests us to state that the rumor that Mr. Barber had resigned the presidency is entirely without foundation, and that as a matter of fact there is no more enthusiastic member in the whole company. The resignation of Mr. Crankshaw as treasurer may have been the cause of this report. Mr. E. R. Stettinius was appointed treasurer about six weeks ago. The officers of the company are: O. C. Barber, president; J. K. Robinson, vice-president; Thomas Deegan, secretary and general manager; E. R. Stettinius, treasurer; H. S. Pell, superintendent.

Messrs. F. P. Jones & Co., of Buffalo, report spring business good. They have within the past few weeks sold and installed three 500-volt, 5-h. p. reversible, elevator Keystone motors; one 500-volt, 5-h. p., one 500-volt, 7½-h. p. and two 500-volt, 1-h. p. direct running Keystone motors; have placed two No. 8, one No. 3 and two No. 10 Keystone dynamos; have sold one 3-h. p., two 2-h. p., two 4 h. p. and one 6-h. p. gas engines for running printers' machinery, ventilating fans, ice cream freezers, etc., and in electric equipment have taken contracts for the City Bank (425 lights), the White Elephant, complete plant (150 lights), T. G. Avery's private residence (400 lights), St. Patrick's Church (300 lights), Steamer Eldorado, L. J. Bennett's residence, Nurses' Home at Buffalo State Hospital, etc. This firm also has a good bell business, and owing to the many new buildings going up they are working a large force of men at this branch of the business.

The General Electric Company has prepared for distribution at the World's Fair a handsome folder of 28-3½ inch × 7½ inch pages, which is alike creditable to the compiler, Mr. John McGhie, to the artist, Mr. Ed. Bartlett, and to the engravers and printers, Bartlett & Co. Besides artistic scroll work on the outer pages there are 50 beautifully executed engravings, some of works and buildings of the General Electric Company and others relating to the various uses to which electricity has been applied. Very interesting are the contrasts presented on neighboring pages between the first manufactories, central station, arc light plant and electric railway station and those of the present day. The various applications of electricity are shown by suggestive illustrations, and the text conveys a great deal of interesting as well as useful information. We predict that the half million of copies printed will scarcely equal the demand that will be created for this artistic souvenir among the visitors to the Exhibition.

The Manhattan Electrical Supply Company, of 36 Cortlandt street, is one of the most wide-awake and enterprising electrical supply firms in this city. This firm reports business exceedingly good, especially in its well known "Mesco" dry battery. This battery has been on the market for the past two years, and as an evidence of its merits the demand for it has continued to increase. The firm has yet to learn of one complaint or any dissatisfaction since its introduction to the public. The Manhattan Electric Supply Company's factory is in Jersey City, and is connected by telegraph to its office, 36 Cortlandt street, New York. Mr. Johnson, the head of the firm, is an old telegraph operator, as are also two other gentlemen associated with him in business; and as one of these ex-telegraphers is at either end of the wire communication is always possible, and much more business can be done, it is claimed, by this means than by telephone. This company has some new specialties nearly completed, which will be introduced to the public very shortly.

The Railway Equipment Company, Chicago, of which W. R. Mason is general manager, reports contracts made for type "G" overhead material during the last few weeks with Tiffin, (O.) Electric Railway Company; Belle City Street Railway Company, Racine, Wis; Norristown (Pa.) Electric Railway Company; South Chicago City Railway Company; Mobile (Ala.) Electric Light and Power Company; Camden & Atlantic Railroad Company, Atlantic City and Camden; Calumet Electric Street Railway Company, Chicago; Trenton (N. J.) Iron Company; Columbia (Pa.) & Ironville Street Railway Company; Lehigh Traction Company, Hazleton, Pa.; Wheeling (W. Va.) Railway Company; Wichita (Kan.) Electric Railway Company; Fox River Street Railway Company, Green Bay, Wis.; Pottstown (Pa.) Passenger Railway Company; Wyandotte & Detroit River Railway Company, Ecorse, Mich.; Cumberland (Md.) Electric Railway; Montreal (Can.) Street Railway; Independence (Ia.) & Rush Park Railway; Westminster & Vancouver Tramway Company; Gettysburg (Pa.) Electric Railway; Second Avenue Passenger Railway, Pittsburgh; Pittsburgh & West End Passenger Railway; Escanaba (Mich.) Electric Street Railway Company; Atlantic Avenue Railroad Company, Brooklyn and Hammond (Ind.) Electric Railway Company.

Business Notices.

Transformers rewound and repaired. Write for prices. The Hill Manufacturing Company, Salem, Va.

Oil Filters for sale cheap. Prices on application to Purity Oil Filter Manufacturing Company, 901 Water street, Pittsburgh, Pa.

Battery Cut-Out, Cheap.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company of 105 South Warren street, Syracuse, N. Y.

A Pointer for Travelers in Chicago.—I have just made another trip to Chicago, the Windy City (by and by this will be called the "Smoky City," unless something is done to obviate the use of soft coal). I traveled over the New York Central road on the most comfortable train in the world—the Chicago Limited. I left New York at 10 o'clock one morning and was in Chicago the next morning at the same hour—a distance of 1,000 miles. The train was made up of Wagner Palace cars vestibuled throughout. There is some pleasure in traveling under such circumstances, and yet I did not feel that I was "putting on style" or indulging in extravagance. "Time is money," someone has said, and I reckon I saved in time more than the cost of the extra comfort. Moreover, the traveling was so smooth and easy that I had none of that "tired feeling" which one usually gets on the cars, and when I reached my destination I was fresh and ready for work. In returning I could not take the same train, but took another one equally as good—the North Shore Limited. On both trains I felt as though I was gliding over ice on skates—the result of the good roadbed and the construction of the cars. Those who visit the World's Fair cannot do better than follow my example.—*The American Bookmaker.*

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

UNITED STATES PATENTS ISSUED MAY 30, 1893.

[In Charge of W. A. Rosenbaum, 177 Times Bldg., N. Y.]

498,236. Telephone System; Emery A. Clark, Sioux City, Ia. Application filed April 5, 1892. A system of service lines converging from outlying stations to a central point, and having at this central point each service wire connected by a branch to its own switch wheel and by other branches to a terminal point on every switchboard in the system, in combination with an accompanying system of switching lines, consisting of one switching wire from each of the outlying stations, converging to the same central point, and there grounded through a common central battery, the switching system being electrically unconnected with and independent of the service system; all in combination with connecting mechanism so arranged and disposed at the point of convergence of the switching lines, and at the outlying terminals, as to be capable of being so manipulated from outlying stations that any one of the service lines may at will, by this mechanism, actuated by the switching system, be automatically placed in electric circuit with any other service line of the system.

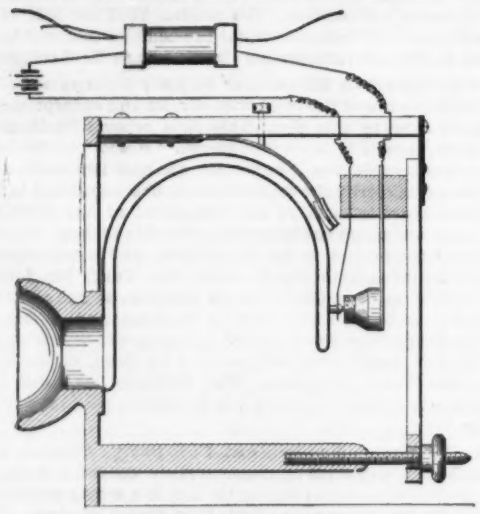
498,243. Telephone Switch; A. G. Davis, Baltimore, Md. Application filed Nov. 25, 1892. The combination with the terminal of a conductor in the main line circuit through the receiver of a telephone, of a movable switchpiece arranged to make contact with such terminal and thereby close the circuit through the receiver; a spring holding the switchpiece out of contact; a vertical sliding rod connected with the switchpiece; and an arm swiveled on the rod and forming a rest for the elbow of the operator while using the telephone.

498,269. Electric Arc Lamp; Louis Hills, New York. Application filed Sept. 2, 1891. The combination in a focusing arc lamp of a rod or support for the upper carbon, formed at its opposite edges with two racks, one engaging with the feed mechanism of the lamp, and an intermediate gear between the other rack and the rod which supports the lower carbon.

498,280. Station Indicator; Max Manuel, Vienna, Austria-Hungary. Application filed Sept. 5, 1892. This comprises take-up rollers with a spring drum, a gear wheel controlled by it, pinions adapted to mesh with the spring drum alternately, intermediate gear wheels keyed to the shafts of these pinions, and with pinions meshing with the intermediate gear wheels and keyed respectively to the shafts of the take-up rollers and with mechanism adapted to both wind the spring drum and to move it laterally with its gear wheel alternately into engagement with the mechanism for alternately revolving the take-up rollers.

498,289. Electrical Signaling System; A. S. McCaskey, Chicago, Ill. Application filed July 29, 1892. The combination of a series of selecting bars, electromagnetic operating mechanism therefor, a series of rods each controlled by a bar or combination of bars, a head bar normally upholding all the rods, and means for depressing the head bar when the desired selecting bar or combination of bars has been operated.

498,290. Railway Block Signaling System; A. S. McCaskey, Chicago, Ill. Application filed July 29, 1892. The combination of a pivoted semaphore arm, a wheel having a projection for engaging and raising the arm, the wheel being normally held stationary by a detent, means for rotating the wheel when released, a magnet for effecting the release, a catch for holding the arm when raised, a magnet for withdrawing the catch, and means for closing the circuit of each of the magnets.



No. 498,309.—TELEPHONE TRANSMITTER.

498,291. Automatic Telephone Exchange System; A. S. McCaskey, Chicago, Ill. Application filed Aug. 25, 1892. The combination with a series of line terminals and connection wires arranged in planes at right angles to the line terminals, and with mechanism for actuating the connection wires to make contact with any of the terminals, of guard mechanism for each terminal wire, comprising guards or stops which are displaced by the movement of any of the connection wires in the other planes.

498,309. Telephone Transmitter; Chas. F. Scattergood, Albany, N. Y. Application filed Dec. 14, 1892. A telephone transmitter consisting of a U-shaped flat tubular spring having one extremity held in a fixed position with the interior of the spring open to the atmosphere, the opposite extremity being closed and left free to vibrate; an electrode arranged to bear against the vibratile portion of the spring, and an electric circuit connected with the electrode. (See illustration).

498,312. Electric Lighting System; Chas. E. Scribner, Chicago, Ill. Application filed June 1, 1889. The combination with the mains of translating devices, each with one terminal connected with one of the mains and the other terminal connected with an individual switch and a pair of contact points for each of the switches, each contact of each pair being connected with a different branch circuit leading to the other main and a switching device in one of the branch circuits.

498,327. Pole Piece for Dynamo-Electric Machines; Elihu Thomson, Swampscott, Mass. Application filed Aug. 26 1892. This device consists of a cast metal pole piece for a dynamo having in its face a number of U-shaped pieces of sheet metal. (See illustration).

498,355. Trolley Catcher; Chas. A. Lord, San Francisco, Cal. Application filed July 12, 1892. In a trolley rope attachment the combination of a reel to which the rope is attached, a tension spring holding the rope in tension, and a stationary support on the car having open bearings that allow the reel to be unshipped and removed.

498,372. Electric Registering Device; Barton B. Ward, New York. Application filed May 28, 1890. The combination with the shaft of a conducting ring and brush bearing thereon, and an eccentric cam carried by the shaft and a conductor connecting the cam and ring.

498,374. Adapter for Lamp Sockets; Henry Price Ball, Schenectady, N. Y. Application filed July 6, 1892. The combination, in an adapter, of a screw-threaded sleeve, an interior edge contact and a central contact, consisting of an insulated eyelet or rivet, to the outer end of which is connected a metal disc or washer.

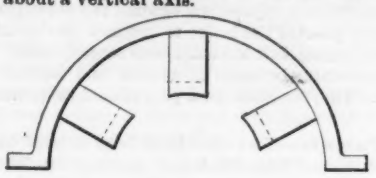
498,387. Electric Arc Lamp; Fred. d'A. Goold, New York. Application filed Nov. 7, 1891. The combination, in an arc lamp, of carbons between which the arc is formed, mechanisms for controlling it, an interposed heat insulating screen consisting of several layers of sheet metal separated by a space or spaces, and a refractory block or plate between the arc and the screen. (See illustration).

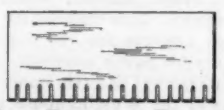
498,403. Electric Railway Trolley; P. F. O'Shaughnessy, New York. Application filed Sept. 27, 1888. In an electric railway, the combination of an overhead conductor, a car, and a reversibly inclined pole carried by the car and having a telescopic section carrying a contact device making an underneath contact, with the conductor.

498,407. Insulated Binding Post; R. H. Rich, Beverly, Mass. Application filed July 15, 1892. This invention comprises an insulated binder post having an insulating body with an adjustable binder screw with insulating pressure cup or washer, a side recess adapted to receive one end of the wire and a metallic shank or screw for establishing electrical connections between the wire terminals.

498,422. Galvanic Battery; Wm. Burnley, North East, Pa. Application filed June 15, 1892. In a dry galvanic battery, the combination, with the positive element consisting of a zinc cup lined with a plastic or semi-solid material containing an exciting agent, of a negative element consisting of a carbon core and granulated carbon, placed in the space between the core and the lining.

498,435. Electric Railway Trolley; R. M. Hunter, Philadelphia, Pa. Application filed March 4, 1892. The combination of a suspended conductor, a traveling vehicle, a current collecting device carried by the vehicle and located between the vehicle and the conductor, movable on a transverse axis, and a support for the collector as a whole hinged to the vehicle and movable completely about a vertical axis.





No. 498,327.—POLE PIECE FOR DYNAMO-ELECTRIC MACHINES.

498,437. Cleaner for Slotted Conduits; John C. Love, Chicago, Ill. Application filed May 17, 1892. The combination with a slotted conduit and a car, of a slot clearer comprising a bar pivoted at its upper end to the car and extending into the slot, and a rigid support limiting the downward movement of the bar for holding the same in operative position.

498,448. Fire Alarm System; Joseph Sachs, New York. Application filed June 24, 1892. The combination of a circuit, a working magnet therein, a normally closed short-circuiting or shunting device around the working magnet, the device requiring more than a single energization of the magnet—for example, an energization and then a de-energization—to open the short circuit.

498,462. Electric Rotary Fan; Julian F. Denison, New Haven, Conn. Application filed March 15, 1892. The combination with a frame of a motor in the same, a fan driven from the motor, a hanger rod and a flexible insulating piece connected with the frame and the hanger rod.

498,468. Electric Alarm Clock; Wm. M. Fowler, Milford, Conn. Application filed May 6, 1892. The combination with a signal, a time indicating device and means for moving it back and forth along a scale, of a contact piece under the control of the time indicating device to operate the signal, and a fixed support for holding the contact piece in the path of the time indicating device.

498,492. Gas Lighting or Extinguishing Apparatus; James Sangster, Buffalo, N. Y. Application filed Dec. 27, 1892. In an apparatus for automatically controlling the flow of gas to burners, the combination with a gas supply pipe of a tank or receptacle mounted thereon and adapted to contain a liquid seal, and a cup substantially rectangular in form pivotally mounted on the tank in an inverted position and having a burner and valve mechanism connected therewith.

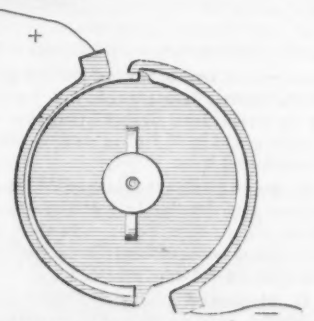
498,519. Electric Perforating Pen; A. D. Lewis, Canton, Mo., and Silas Witherell, Fort Madison, Ia. Application filed April 23, 1892. The combination with an ordinary pen handle and pen of an electrically controlled laterally vibrating perforating reed, mounted exteriorly of and longitudinally on the pen handle, and provided with a point at one end striking adjacent to the point of the pen.

498,529. Printing Telegraph; E. V. Baillard, New Utrecht, N. Y. Application filed Feb. 4, 1893. This consists of the combination of a rotating type-wheel and a ratchet wheel mechanically united, a pawl or ratchet wheel therefor having its armature mechanically connected with the ratchet, a retractor for the armature, a vibrating circuit breaker connected to and moving with the ratchet, a manually operated switch forming a cut-out around the circuit breaker, a press pad and a single main line including in its circuit the first named electromagnet, the vibrating circuit breaker with its cut-out switch and the press magnet.

498,537. Dynamo-Electric Machinery; Chas. E. Dressler, New York. Application filed Oct. 6, 1891. A field pole piece for a dynamo-electric machine, composed of soft iron and provided with hardened steel pins inserted in holes in the iron.

498,538. Electric Generator or Motor; Charles E. Dressler New York. Application filed Sept. 15, 1892. A composite field polepiece for electric generators or dynamo machines, having an exterior of soft iron, an interior of magnetized steel and an intervening medium of low or non-magnetic conductivity.

498,539. Junction Block for Electric Fixtures; Fred. A. Duggan, Trenton, N. J. Application filed Feb. 24, 1893. An electrical cut-out or junction block of approximately horseshoe form, having slots passing laterally through its body, paralle with each other, and having on its outer side plane faces at angle to each other, in combination with flat metal plates fitted to th plane faces and securing screws for the plates passing at angle through the parallel slots.



No. 498,387.—ELECTRIC ARC LAMP.

498,550. Mail Receptacle; Andrew Holtum, Racine, Wis. Application filed Oct. 18, 1892. This is a box having a contact spring secured to the inner rear wall, a contact pin projecting from the wall in line with the free end of the contact spring and normally free from contact therewith, circuit wires electrically connected with the spring and pin, a suitable source of electric current and a signaling device in circuit with the wires, a front opening to the box and a hinged lid having an inward projecting arm integral therewith, free from contact with the spring when the lid is fully opened or closed, but adapted to impinge against the spring in the act of opening or closing the lid, and thereby close the circuit and operate the signal.

498,560. Electric Cut-Out; William P. Mashinter, Montreal, Can. Application filed July 5, 1892. In an electric film cut-out a pair of insulated contacts, one fixed and the other movable; a film carrier; a film mounted on said carrier and extending between said contacts; auxiliary contacts, and means for operating said movable contact, rotating said carrier, and effecting a union between said auxiliary contacts.

498,566. Electric Arc Lamp; Paul Nordmann, Berlin, Germany. Application filed Nov. 16, 1892. An electric arc lamp comprising two or more pairs or groups of pairs of carbons connected in series, and in which two or more luminous arcs are simultaneously produced and maintained, and mechanism for controlling each pair or group of pairs of carbons.

498,573. Automatic Cut-Off for Musical Instruments; Constantin Riegger, Louisville, Ky. Application filed Dec. 16, 1892. In an electrical musical instrument, the combination of a sheet, card, or tablet provided with a slot or projection, and a lever or other device connected with the terminals of the circuit, and adapted to engage with said slot or projection.

498,577. Electric Locomotive; Albert Schmid, Allegheny, Pa. Application filed Nov. 16, 1891. In an electric motor, a supporting frame for carrying the armature and field magnet, said field magnet being constructed in two sections, one section being hinged to the said frame upon its upper side at one end, and the other section being hinged to the said frame upon its lower side and at the other end.

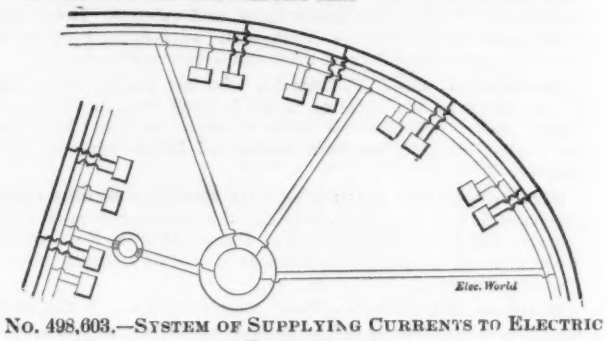
498,585. Electrical Rotary Motor; William J. Still, Toronto, Canada. Application filed Dec. 28, 1891. In an electric rotary motor, the combination with the shaft and the magnets disposed in a circle about the shaft, and adapted to be magnetized and demagnetized, of an armature mounted on the shaft and adapted to turn loosely thereon within certain limits, a positive connection between the said shaft and the armature to take the load and cause the shaft and the armature to revolve together, and a yielding connection permitting a momentary delay in the rotation of the armature by reason of the magnet not instantly demagnetizing without checking the speed of the shaft, and constructed to cause the said armature to regain itself and come in contact with a stop after being released from the delaying influence of said magnet.

498,603. System of Supplying Currents to Electric Railways; Charles Zipernowsky, Budapest, Austria-Hungary. Application filed March 7, 1891. In a system of electrical distribution and conversion, high potential alternating current primary conductors and low potential continuous current secondary mains in combination with a number of intermediate converting appliances, each consisting of a combined alternating current motor and continuous current dynamo connected up to the primary and secondary conductors, which latter are common to the several converting appliances, whereby the dynamo of each converting appliance is first supplied with continuous current from the common secondary mains to start its motor, and the latter then drives the dynamo to supply current to the secondary mains. (See illustration.)

498,604. Electric Arc Lamp; Hugh Alexander, Brooklyn, N. Y. Application filed April 19, 1890. In an electric lamp, the combination with the solenoid formed of one or more helices of insulated wire wound upon a tube of a movable core magnet rod or tube contained wholly within the solenoid tube, and carrying with it into said tube a connecting feed rod or tube, a carbon clamp and the upper carbon, for the purpose of shortening the lamp by bringing the contact point of the two carbons together and striking an arc near the helix.

498,607. Operating Street or Station Indicators; Reuben B. Ayres, New York, N. Y. Application filed Dec. 22, 1891. In an electric railway car system, the combination with the trolley wire and trolley, an automatic indicator located within the car, of a stationary electrical contact supported by said wire, a corresponding movable contact mounted on the trolley, and electric conductors leading therefrom to the indicator.

498,624. Electric Car Brake; Nicholas J. Chute, Schenectady, N. Y. Application filed Oct. 24, 1892. A solenoid for car brakes comprising a cylinder having an air chamber and an air outlet therefor, a core fitting closely in said cylinder and a brake mechanism connected with said core.



No. 498,603.—SYSTEM OF SUPPLYING CURRENTS TO ELECTRIC RAILWAYS.

498,671. Printing Telegraph; Donald Murray, Sydney, New South Wales. Application filed Nov. 3, 1892. In a printing telegraph, the transmitter comprising a commutator or board having a series of contacts thereon, arranged in pairs and with direct and crossed connections with the line, and a key-operated, insulated contact block carrying contact points adapted to move over the pairs of contacts on the commutator and close the circuit through the same.

498,698. Revolving Fuse Holder; Charles H. Ruggles, Lynn, Mass. Application filed Dec 12, 1892. A revolving fuse holder comprising a hollow case, a spool mounted therein carrying a number of fuses, contact plates for completing the contact between the circuit and the fuses, and an arm connected to the spool and passing through a slot in the case for operating the spool, and grooves in the bottom of the slot for holding the arm so that the brushes will be in their proper position relative to the contact plates.

498,707. Copper Coating the Hulls of Vessels; Thomas S. Crane, East Orange, N. J. Application filed Oct. 12, 1892. The means for electroplating a section of a ship's hull, consisting of a bath-holder for confining the plating solution to one portion of the hull, a fixed body adjacent to the bath-holder, an extension shore inserted between the bath holder and the fixed body, an anode within the bath-holder and suitable electrical connections.

498,710. Electric Time Alarm; Charles S. Gibson, South New Berlin, N. Y. Application filed Oct. 12, 1892. In an electric signaling system, the combination with bell and clock circuits electrically connected, and a wheel of the clock having a single projecting stud, a circuit closer included in the clock circuit and comprising normally separated spring wire terminals, one of which lies alongside of the studded wheel and is adapted to be engaged by the stud to close the circuit with the other terminal and regulate the duration of the sounding of the signal.

498,722. Trolley for Electric Cars; Robert D. Nuttall, Allegheny, Pa. Application filed July 14, 1891. In a trolley for electric cars, the combination of a spring, a cross-head arranged at the end of the spring and a pivoted mast socket connected to said cross-head, the mast socket being so constructed as to effect an inward movement of the cross head, and a corresponding pressure of the spring at every point of movement of the mast socket.

498,723. Electric Railway Trolley; Robert D. Nuttall, Allegheny, Pa. Application filed May 10, 1892. In a trolley, the combination with compressible spiral springs, one within the other, a cross head at the outer ends thereof, a pivoted yoke having projections on one side of each limb, and flexible connections between the yoke and the cross head.

498,735. Electric Welding Apparatus; John H. Bassler, Myerstown, Pa. Application filed Aug. 23, 1892. In an electric welding apparatus, an electric circuit, means for energizing the same, and a pair of reciprocating electrodes, vibrating in a direction at right angles to their lengths and included in the circuit.

498,743. Galvanic Battery and Electrical Toy Instrument; Wm. A. Connelly, Boston, Mass. Application filed Sept. 1, 1892. In an electrical battery and toy instrument, the combination of the following instrumentalities, viz., a battery consisting of superimposed positive and negative elements, and an electrolytic material interposed between said elements, the lower element having a stud or post extended up to or above the upper element, a supporting frame or case for said battery, a cover or plate for said frame or case, contact springs or devices permanently fixed to the under side of the plate or cover and engaging the upper element of the battery and the stud or post of the lower element, and an electrical toy instrument secured to the upper side of the toy plate or cover and electrically connected to the said contact springs or devices.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1886 - can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.